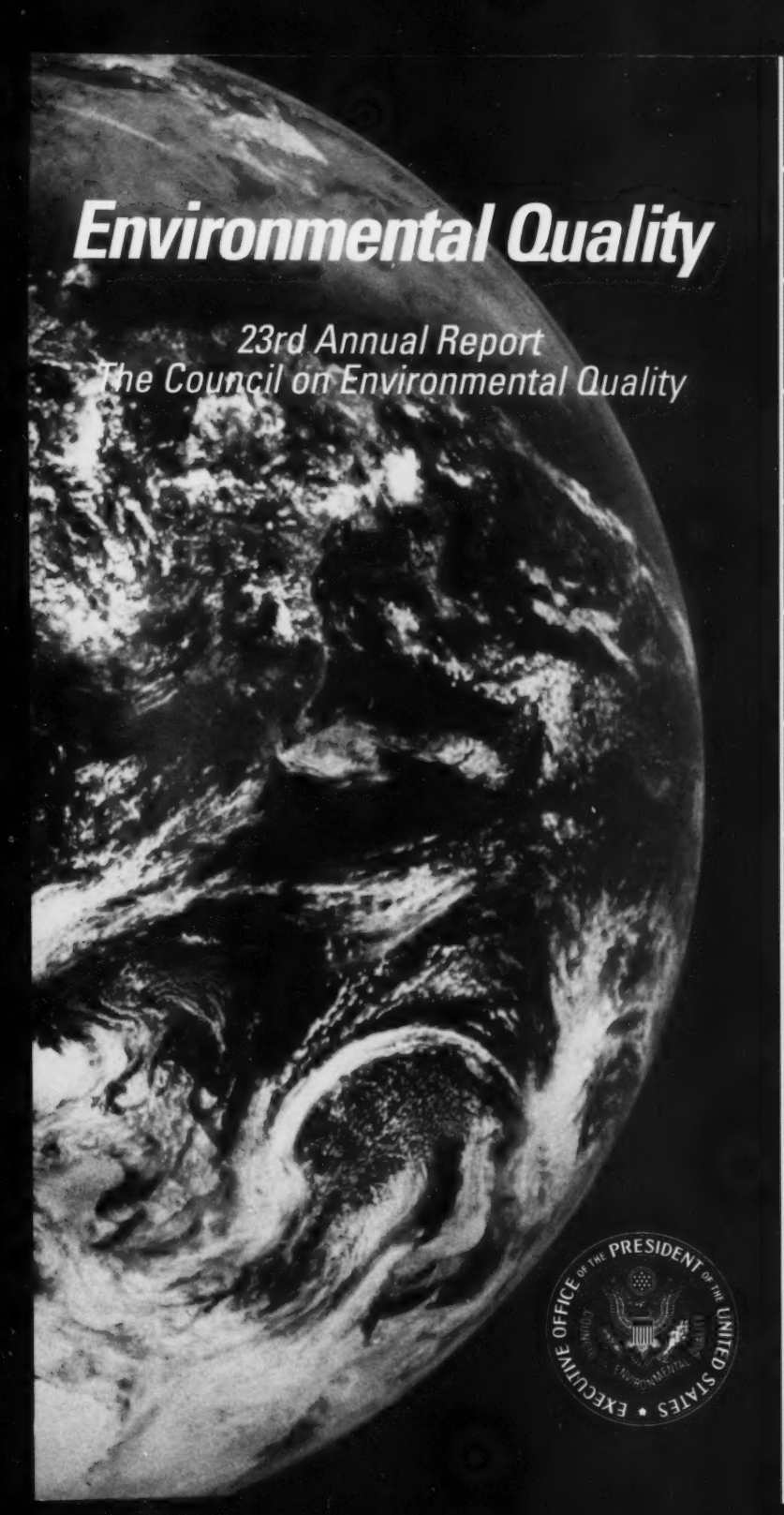


Environmental Quality

23rd Annual Report
The Council on Environmental Quality

PRESIDENT'S MESSAGE

THE VIEW FROM CEQ

AGRICULTURE

AIR QUALITY

BIODIVERSITY

COASTS & OCEANS

DEPARTMENT OF DEFENSE

ECONOMICS

EDUCATION

ENERGY

ENFORCEMENT

FEDERAL FACILITIES MANAGEMENT

FISHERIES & MARINE MAMMALS

Environmental Quality

The Twenty-Third Annual Report of the
Council on Environmental Quality together with
The President's Message to Congress

Co-Editors:	Dale Curtis Barry Walden Walsh
Editorial Staff:	Dinah Bear Allan Bedwell Elizabeth Blaug Patricia Bliss-Guest Ray Clark Jonathan Elkind Lawrence G. Flick Charles N. Herrick Mary Holland Lee Langstaff Seth Miller John Mostyn Andrew Neblett Robin O'Malley Spencer Phillips Lucinda Low Swartz Patience Whitten Jane Yager
Data and Trends Staff:	Carroll Curtis Charles N. Herrick
Graphics Coordinator:	Seth Miller
Support Staff:	Kathleen Gallagher Connie Lacey Gloria Robinson Kristina Rohan Sally Verser
Design:	Jim Page Kelli Sechrist
Cover:	Bill McIntosh
Business Manager:	Donna Connell
Printing Manager:	Steve Jewell

The editors would also like to thank numerous federal colleagues for their assistance in preparing and reviewing this report.

Council on Environmental Quality
January 1993

This report's cover and pages are printed on recycled paper.

For sale by the U.S. Government Printing Office
Superintendent of Documents, Mail Stop: SSOP, Washington, DC 20402-9328
ISBN 0-16-041612-4

The index and/or ta
been removed ar
separately within this

For roll film users, thi
current volume year
of the microfilm. For
this information is
microfilm.

For microfiche users
contents is contained

table of contents has
and photographed
his volume year.

his information for the
ar is at the beginning
or a prior year volume,
is at the end of the

ers, the index and/or
ed on a separate fiche.

The President's Message on Environmental Quality

To the Speaker of the House of Representatives and the President of the Senate:

During the past 4 years, the world has witnessed major changes in the political profile of nations. The Earth Summit, sponsored by the United Nations in Brazil in June 1992, signaled the next era in world history—one characterized by the recognition that environmental protection, economic development, and public participation in decision-making are interrelated and crucial to our future quality of life.

In these last four years, the United States charted an ambitious agenda to remain in the vanguard of environmental protection by harnessing the energy of capitalism in service of the environment. Those who said that we posed a false choice between a strong economy and a healthy environment disregarded our words and our deeds. We worked to achieve both while sacrificing neither—as must all nations in the coming century.

Economic development and environmental protection go hand in hand. Economic growth supplies the financial and technological resources necessary for environmental enhancement; while its opposite, the struggle for bare survival, places strains on natural protection. We have seen this phenomenon in America as our economy grew in the 1980s and waters and skies became cleaner, just as we have seen it in the degraded forests and rivers of Eastern Europe and in the faces of Africa's starving children. The challenge for leaders in all parts of the world is to ensure both economic growth and environmental progress at the same time.

A Strategy That Produced Results

The pioneer American conservationist, Gifford Pinchot, once remarked, "There are just two things on this material earth—people and natural resources." Human beings are not intruders in nature but an essential species with a responsibility to sustain other species.

The Bush administration combined an understanding of human nature with an idealism about Mother Nature in developing a National Strategy for Environmental Quality, based on six goals:

- Harnessing the power of the marketplace;
- Managing natural resources as responsible stewards;
- Promoting creative partnerships;

- Developing cooperative international solutions;
- Preventing pollution before it starts;
- Enforcing environmental laws firmly and fairly.

And the strategy worked. In just four years, consider what has been accomplished:

Clean Air Act Amendments of 1990: We broke 10 years of congressional gridlock to enact the world's most protective and cost-effective clean air legislation. At its heart is an innovative, market-based, emission-allowance trading system. During the past 2 years, we proposed and finalized rules that promise to achieve 85 percent of the anticipated pollution reductions.

Budgets: By shifting Federal funds from other programs to environmental programs, we were able to increase the operating budget of the Environmental Protection Agency by more than 50 percent and increase funding for clean energy research and development by 66 percent.

Pollution Prevention: Market-driven pollution prevention efforts by the private sector are reshaping American industries, making us leaner and more efficient. For example, under just one Administration initiative, the EPA 33/50 program, more than 900 companies have reduced releases and transfers of toxic chemicals by 347 million pounds—25 percent below the 1988 baseline, with enormous savings in operating costs.

Enforcement: We broke new ground and old records, filing more cases, collecting more penalties, and putting more polluters behind bars than every previous administration in history combined.

Public Lands: We helped make America's great outdoors even greater by investing over a billion dollars to acquire wetlands, improve campgrounds, and add half a million acres to our national parks and 1,200 miles to our Wild and Scenic River System. We created 57 new wildlife refuges—more than any administration in history. We adopted a philosophy of ecosystem management and ended clearcutting as a standard practice on Federal land. The America the Beautiful initiative got off to a good start with the planting of more than 225 million new trees in rural and urban areas across the nation.

Coasts and Oceans: To ensure that America's seas always will shine, we ended the ocean dumping of sewage sludge. We proposed and won passage of the Oil Pollution Act of 1990, a vigorous anti-pollution measure. To protect our ecologically sensitive coastal areas, we imposed a 10-year moratorium on oil and gas leasing and added six national marine sanctuaries, including the Monterey Bay sanctuary off California—which is second only to Australia's Great Barrier Reef as the largest marine protected area in the world.

Energy: We launched a new generation of clean energy technologies, not only by increasing funding for research and development but also by increasing incentives for the application of new technologies. We proposed and won passage of comprehensive national energy legislation with the National Energy Policy Act of 1992, an act that will guide the United States into the next century.

Federal Leadership: We tripled funding for Federal facility cleanups, especially at nuclear weapons manufacturing sites, and secured more than 100 enforceable cleanup agreements at Federal facilities. Executive orders spurred the Federal Gov-

ernment to speed improvements in energy efficiency, recycling, waste reduction, and conversion of the federal fleet to alternative fuels.

International Leadership: We insisted that a new world order include a cleaner world environment and reached 27 new international environmental agreements. We made America the world leader in phasing out ozone-depleting chlorofluorocarbons (CFCs) and led the way to a global ban on driftnet fishing. We launched a Forests for the Future initiative that proposed doubling international aid for forest conservation as a step toward halting global deforestation and dieback. We reduced Poland's debt to help that nation fund a new environmental foundation, and we launched the East-West Environmental Center in Budapest, Hungary, to help countries in Central and Eastern Europe. We addressed environmental protection in trade negotiations with Mexico, expanded debt-for-nature swaps to protect rainforests in Latin America, and created a network for environmental cooperation with Asia.

Global Climate Change: Our comprehensive action-oriented approach to global climate change was adopted by the world community at the United Nations Conference on Environment and Development in Brazil and ratified unanimously by the U.S. Senate. The United States was the first industrialized nation to ratify the treaty and the first nation to set forth its action plan to reduce greenhouse gas emissions.

President's Commission on Environmental Quality (PCEQ): This presidential commission was unique because it was not created to provide advice but rather to demonstrate innovative ideas through action. Over the last 18 months, PCEQ built a network of more than 200 organizations to design and carry out 10 voluntary initiatives on such issues as biodiversity, energy efficiency, education and training, and environmental management.

President's Environment and Conservation Challenge Awards: We established a Presidential medal to honor those who honor the environment. Medal recipients have forged innovative solutions across the environmental spectrum from agriculture to manufacturing to small business, from the classroom to the great outdoors and back to the inner city. Their good deeds have improved our nation's air, water, and lands.

Why the Strategy Worked

Too often, the federal government has adopted goals with little regard to costs, practicality, or actual degree of risk. At times our environmental laws and regulations have been unnecessarily costly and punitive, especially for small businesses and communities.

That is why our environmental strategy was based on concepts that will make environmental protection a practical goal, consistent with economic growth. In an era of large federal deficits and intense international economic competition, our country cannot afford policies that ignore costs.

A free society needs sensible regulation; our emphasis on market incentives and voluntary collaboration was credible because of its link to vigorous law enforcement, which motivated businesses to be innovative. But we cannot rely solely on the legislate-regulate-litigate pattern of the past. That approach will waste more time and money than it saves, hurting our economy and environment in the process.

Looking Forward

Our national environmental strategy has produced lasting benefits that prepare the stage for additional progress in the future. These and many other accomplishments in environmental quality are possible within the coming decades:

I look forward to a time when our natural vistas and urban skylines are never obscured by smog.

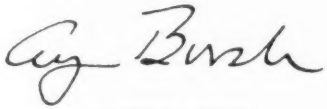
I look forward to the day when all industrial corporations can improve their energy efficiency and eliminate toxic discharges into the environment, at a profit.

I look forward to a less contentious era when ecologists, business people, and community leaders collaborate in finding ways to protect species and ecosystems without sacrificing an area's long-term economic development potential.

I look forward to the day when our scientists can tell us how to reorient regulations toward problems that pose the greatest risks to human health and the environment. A more scientific approach to setting priorities could save the country many billions of dollars while focusing on the greatest risks.

I look forward to the day when trade agreements are routinely matched by closer environmental cooperation. Trade liberalization is crucial to the growth of America and every nation in the 21st century, and growth is the key to greater environmental protection. Trade-environmental linkages are a practical way to realize sustainable development, especially for the developing nations which need it so desperately.

In the years ahead, we can take pride in what the American people helped us accomplish to protect our environment. We can be comforted by the knowledge that the next generation will continue the work we started to leave a better world.



GEORGE BUSH
The White House
January 1993

EXECUTIVE OFFICE OF THE PRESIDENT
COUNCIL ON ENVIRONMENTAL QUALITY
WASHINGTON, DC 20500

Letter of Transmittal

The President:

Sir: The Council on Environmental Quality herewith submits its Environmental Quality Report for the year 1992 in accordance with section 201 of the National Environmental Policy Act of 1969 (42 U.S.C. 4341).

Sincerely,

Michael R. Deland
Chairman

From the Chairman: The View from CEQ

Is the Earth's environment improving or in decline? This is often the first question posed by readers of the CEQ annual report. The question is a fair one, since the National Environmental Policy Act of 1969 (NEPA) requires CEQ to provide the nation with a comprehensive view of environmental conditions and trends.

The answer to this question is necessarily mixed. Some indicators are deeply troubling, while others are more promising. This report defines in detail the aspects of environmental quality that are getting better and the challenges that remain.

Conditions and Trends

Perhaps the greatest cause for optimism is the shift in the direction of policy that has occurred in the last four years. The Bush administration—and many governments around the world—began to promote economic and environmental goals in tandem, rejecting the view that economic growth and environmental quality are opposite interests. Building upon the progress of the past 20 years, we sought to create a less contentious, more efficient policy framework by expanding the use of such tools as market incentives and voluntary alliances. I am hopeful that the lessons learned from this experience will continue to provide a blueprint for establishing what the President has called, "a new kind of environmentalism."

Many serious environmental problems do persist. Sites contaminated by pollution from the past still await cleanup; many cities still strive to meet clear air standards; and too many coastal, wetland, and forest ecosystems are being degraded by pollutants and harmful practices. Internationally, nations struggle to produce strategies for sustainable development.

Early in his Presidency, in a June 1989 speech to the Ducks Unlimited organization, President Bush outlined a strategy for environmental quality based on six broad goals. Major events and trends in 1992 demonstrated the practical applications of this strategy:

- **Harnessing the Power of the Marketplace.** The first major transaction involving tradable air pollution allowances occurred in May

The White House.

President Bush meets with members of the President's Commission on Environmental Quality: (l to r) Marguerite Ross Barnett, Edwin L. Artzt, Michael R. Deland, the President, and William D. Ruckleshaus.

1992, when the Tennessee Valley Authority (TVA) purchased 10,000 emission allowance credits from Wisconsin Power and Light—setting in motion an innovative mechanism for reducing air pollution. Through this and other new programs, the Bush administration pioneered the use of market incentives as an effective, efficient way to reduce and prevent pollution.

• **Managing Natural Resources as Responsible Stewards.** In June 1992 the DOI Bureau of Land Management and the USDA Forest Service adopted a philosophy of ecosystem management to protect and restore the integrity of soils, air, water, and biodiversity on lands under their jurisdiction. Both agencies are undertaking forestry initiatives that will phase out clearcutting as a standard practice on federal lands. Also in the past year, the President designated four new national marine sanctuaries off the coasts of Texas and Louisiana, California, Massachusetts, and Hawaii.

• **Promoting Creative Partnerships.** This past year, the President's Commission on Environmental Quality, which I chair, implemented ten significant initiatives to improve the environment, involving more than 200 organizations. Participants from business, environmental, academic, and philanthropic organizations have shaped the commission into a creative "can do" partnership, with willing partners from groups once considered strictly adversarial.

• **Developing Cooperative International Solutions.** In June 1992 at the United Nations Conference on Environment and Development in Rio de Janeiro, the United States endorsed four major accords, including the Framework Convention on Climate Change. In the months leading up to Rio, the United States worked hard to shape a comprehensive, action-based climate treaty. Last fall we became the first industrialized nation to ratify the treaty; we were the first nation to set forth our action plan to reduce greenhouse gas emissions.

• **Preventing Pollution Before It Starts.** Nineteen months after proposing a National Energy Strategy, President Bush signed into law

the National Energy Policy Act of 1992. The law sets new standards for energy efficiency, calls for a federal fleet of clean alternative-fuel vehicles, and establishes a voluntary system for private sector reporting of greenhouse gas emissions—provisions to prevent pollution at its source. The Bush administration increased funding by 66 percent to $540 million for such energy research and development as clean-coal technologies and alternative fuels.

• **Enforcing Environmental Laws Firmly and Fairly.** In 1992 the federal government collected record civil and criminal penalties, among them those stemming from the Exxon Valdez oil spill case—the largest environmental settlement in history. The past year was a record one for environmental enforcement, with the dollar value of federal enforcement actions approaching $2 billion. Firm and fair enforcement is acting as a powerful incentive for innovation and pollution prevention.

CEQ Year in Review

Working closely with federal colleagues, environmentalists, business people, scientists, foreign officials, and concerned citizens, the interdisciplinary team at CEQ fulfills several functions:

- advising the President and other senior government officials on environment-related issues;
- overseeing federal agency implementation of the National Environmental Policy Act;
- collecting, analyzing, and reporting data on conditions and trends in the environment; and
- coordinating various interagency efforts.

Among our priority efforts in 1992 were the following:

Environmental Data Reporting. CEQ publishes environmental trends information in the annual *Environmental Quality* report and in periodic issues of the award-winning publication, *Environmental Trends*. The Council chairs an Interagency Committee on Environmental Trends (ICET), which provides an ongoing forum for coordinating and synthesizing environmental data collection and analysis. ICET plans to issue another state-of-the-environment report by 1994, linking data on environmental stresses and human activities.

Environmental Education. CEQ chairs the *ex officio* committee of the nonprofit National Environmental Education and Training Foundation (NEET). The Council also participates in the work of the Federal Task Force on Environmental Education, established by the National Environmental Education Act of 1990.

International Affairs. Following two years of contributions to preparatory sessions, CEQ participated in the U.N. Conference on Environment and Development (UNCED), held in June 1992 in Rio de Janeiro. Specifically, we met frequently with foreign officials and helped resolve disputes regarding the global climate treaty, funding and structure of the Global Environment Facility, and establishment of a biodiversity research initiative. With the Department of State, the Council co-chairs a working group on implementation of Agenda 21, the action plan for sustainable development adopted at UNCED. CEQ has been designated to conduct public outreach on UNCED

follow-up and we participate in working groups on UNCED initiatives and accords, such as Forests for the Future, and the U.N. Framework Convention on Climate Change.

CEQ was also a key adviser in the President's decision to accelerate the phaseout of substances that damage the Earth's ozone layer.

National Acid Precipitation Assessment Program (NAPAP). CEQ chairs the NAPAP Council, the interagency coordinating group through which federal agencies cooperate to advance acid rain research and monitoring. NAPAP has developed a long-term plan to assess the costs, benefits, and adequacy of the acid rain provisions of the Clean Air Act as they are implemented—the first time such a provision has been included in a major environmental statute.

National Environmental Policy Act. CEQ issues regulations for the environmental impact assessment process that are binding on all federal agencies. In 1992, the Council published a report growing out of a series of regional workshops on consideration of biodiversity in the EIA process. CEQ also published a compendium of NEPA training courses and developed a Federal Environmental Quality Awards Program to showcase model NEPA compliance.

President's Environment and Conservation Challenge Awards. CEQ implemented and administers this awards program, established by President Bush to honor those who honor the environment. Recipients of presidential medals are selected by an independent panel of experts for outstanding achievements in the categories of environmental quality management, partnerships, innovation, and education and communications.

President's Commission on Environmental Quality (PCEQ). CEQ organized, chaired, and provided administrative support for the commission, whose members are business, environmental, academic, and philanthropic leaders. In 1992 PCEQ launched ten initiatives to test innovative methods of pollution prevention, energy efficiency, natural resources stewardship, international cooperation, and education and communications. The Commission prepared a report to the President and the nation to be released in January 1993.

Wetlands, Coasts, and Water. As a member of the Domestic Policy Council Task Force on Wetlands, CEQ advanced the President's no net loss goal and called for a scientific study to determine the best procedures for identifying wetlands. In 1992 CEQ conferred with federal agencies on plans to reauthorize the Clean Water Act. The Council also coordinated Coastal America, an interagency initiative that is restoring, preserving, and protecting the nation's living coastal heritage. In addition to providing administrative and management support, CEQ hosted the Coastal America staff office.

Those interested in further information about these and other CEQ activities may call 202-395-5750 or write CEQ at 722 Jackson Place, NW, Washington, DC 20503.

An All-American Challenge

This, my final report as CEQ chairman, is submitted with mixed emotions—with recognition of challenges

unmet but with a sense of satisfaction in the environmental accomplishments of the last four years. In keeping with the President's directive, CEQ was revitalized and staffed with dedicated, caring public servants who labor to help the President make this world a cleaner, safer place. For me, it has been a special privilege to work with this team and to serve a President whose commitment to environmental stewardship comes from the heart.

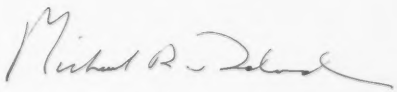
George Bush kept his promise to the American people; he was the environmental President, with an unmatched environmental record. As historians will note, no administration has done more to foster continuous environmental improvement, both in the short- and long-term.

But as President Bush once wrote, "Environmental progress must flow from action by all Americans, not just government action." The federal government plays a crucial role in research, public information, standard setting, and enforcing the law. But government action alone cannot substitute for what philosopher Aldo Leopold termed "a universal symbiosis with land, economic and esthetic, public and private." The hallmark of the Bush environmental strategy has been to expand the set of policy tools to include market incentives and voluntary partnerships, to spur actions that regulation alone cannot.

And the response has been heartening. Outstanding progress is being made from the nation's largest corporations to individuals at the grass roots. For example, one of the initiatives of the President's Commission on Environmental Quality involved 11 industrial corporations that volunteered to use the philosophy of Total Quality Management to prevent pollution at their facilities. Practical business people found that they could cut emissions and save money at the same time.

Another example is Hazel Johnson, recipient in November 1992 of a presidential medal for environmental achievement. Ms. Johnson is the founder of a group in Chicago that serves a predominantly low-income, African-American community by assessing and reducing environmental hazards in homes and workplaces. Yet another medal recipient was the Florida Save Our Everglades program, harnessing the knowledge and energy of four different arms of government and 22 conservation groups.

As chairman of CEQ, with a responsibility to coordinate federal environmental activities, it may seem paradoxical that I close by emphasizing the role of the private sector, the community, and individuals. Yet I do so because the most important trend in the world today is greater freedom, which is the antithesis of a command-and-control mentality. And freedom carries with it corresponding responsibilities, including stewardship of the environment we all share. The stakes are too high, and the consequences for our children too crucial to entrust this sacred responsibility to anyone other than ourselves. It is that simple and that important.



Michael R. Deland

PART I: Environmental Issues and Policies

Agriculture

Also see Forestry, Water, Wetlands, and related tables and figures in Part II.

U.S. agriculture is in the midst of a major transition motivated by economic and environmental factors. These include the budget deficit, the expansion of international trade, water quality and quantity, topsoil erosion, and the compatibility of agricultural practices and the environment. In the midst of change, U.S. agricultural policies seek to balance several objectives:

- An abundance of food and fiber at reasonable prices,
- Economic security for agricultural producers, and
- Conservation of natural resources.

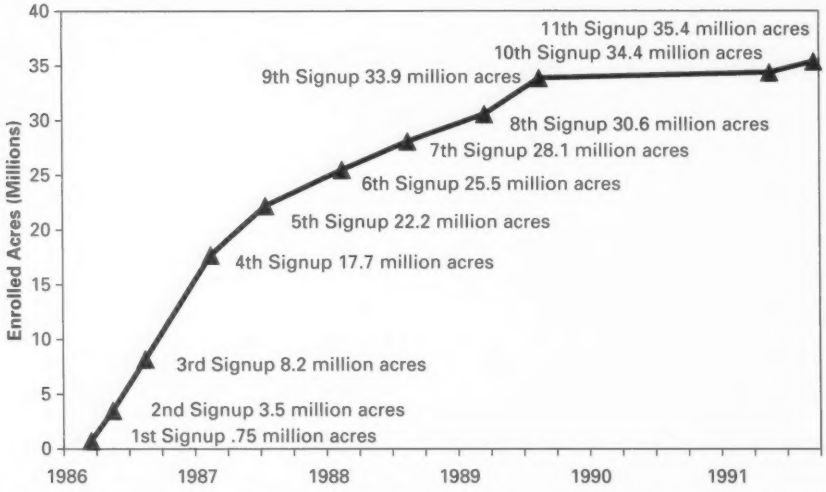
Conditions and Trends

Between 1982 and 1987 nonfederal cropland acreage increased by 1.4 million to 422.8 million acres, and nonfederal rangeland acreage decreased by 6 million to 401.7 million acres. Land-use shifts can be complex. For example, the net increase in cropland reflected the conversion of 16.2 million acres of cropland to other uses, while 17.6 million acres were converted from other uses to cropland.

The environmental consequences of these land-use shifts are also complex. Shifting land from other uses to crop production increases soil erosion and the risk of nutrient and pesticide contamination associated with current agricultural practices. Shifting land from crop production to other uses, on the other hand, increases environmental impacts from nonfarm uses, such as runoff of toxins from roadways and parking lots and vehicle emissions associated with urban development.

Since 1985 several hundred million acres of cropland have been idled as a result of conservation provisions in farm legislation. In 1987 alone 76 million acres out of a total cropland base of 321 million acres were idled under Farm Bill conservation and supply-control provisions. In 1992 a total of 54 million acres were idled out of the 343 million acres of crop acreage base. This

Cumulative CRP enrollment.



Note: CRP = Conservation Reserve Program. The legislative mandate for combined CRP and Wetlands Reserve Program (WRP) enrollments is 40 million to 45 million acres by the end of 1995. CRP enrollments last for ten years, hence these lands could lose protective status in future years.

Source: See Part II, Table 48.

figure includes acreage enrolled in the Conservation Reserve Program.

Policies and Programs

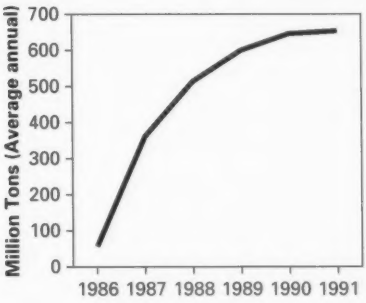
Federal farm legislation in 1985 and 1990 linked farm program benefits and the conservation of natural resources. The Department of Agriculture (USDA) conducts conservation programs to reduce soil erosion, protect wetlands, maintain and enhance wildlife habitat, and improve water quality, while achieving supply-control and income-support objectives in a cost-effective manner.

Conservation Compliance

The 1985 Farm Bill contained conservation compliance provisions that require farmers to develop and implement approved conservation plans on highly erodible cropland by 1995. Farmers who do not implement conservation plans lose USDA program benefits. As of July 1992 field personnel of the USDA Soil Conservation Service had helped 1.3 million farmers develop compliance plans that will reduce erosion on 135 million acres of highly erodible cropland. These plans call for 215,000 miles of terraces, 1.3 million acres of grassed waterways, 4,200 miles of erosion-control diversions, cropland contour farming on 25 million acres, and cropland conservation tillage on 100 million acres. As of July 1992 farmers had implemented conservation plans on over half the acres requiring conservation practices.

To bolster conservation compliance, USDA supports alliances among agricultural businesses, commodity

Erosion prevented on CRP lands.



Source: See Part II, Table 48.

groups, grower associations, and the farm news media. These alliances encourage conservation practices such as leaving crop residue on the soil surface during critical erosion periods. Farmers have chosen some form of crop residue management on 75 percent of the highly erodible land in compliance plans. Working with the alliances, USDA provides technical information and assistance through demonstrations, direct mail, brochures, workshops, advertisements, and features in the farm-oriented media.

Conservation Reserve Program

The Conservation Reserve Program (CRP) offers farmers an incentive to remove highly erodible cropland and other environmentally sensitive land, such as wetlands, from production for at least ten years. Farmers who enroll in the program receive ten annual rental payments for idling the land and cost-share help in establishing a cover of grass or trees. Producers who plant hardwood trees or construct wildlife corridors, windbreaks, or shelterbelts may request contracts up to 15 years in length.

As of August 1992 farmers had enrolled 36.5 million acres in the program, resulting in numerous environmental benefits. Average soil loss on CRP lands has declined to one-tenth of the former rate, from 21 to 2 tons per acre per year. Farmers are planting 2.4 million acres in trees; 31 million acres are in grass, predominantly in the prairie and Great Plains region; and another 2 million acres are in plantings beneficial to wildlife. In 1989 farmers entered 410,000 acres of farmed wetlands in the program. In the prairie pothole region of North and South Dakota, during one sign-up period alone, the program enrolled 150,000 acres of farmed wetlands. Under one program option, 13,000 acres of shallow-water wetlands are being restored. Eligibility has been extended to saline lands and to cropland that contributes to water quality degradation. Incentives encourage the planting of hardwood trees in woodland, windbreaks, shelterbelts, and wildlife areas. A total of 23 U.S. watersheds, including the Chesapeake Bay and the Great Lakes, are designated Conservation Priority Areas and, as such, receive preference in program enrollments.

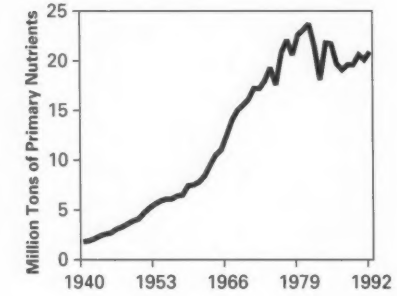
In addition to reducing soil erosion, CRP reduces pesticide use on land enrolled in the program by an estimated 30,000 tons annually and fertilizer use by an estimated 2.4 million tons annually. Because CRP may create an incentive to increase the intensity of fertilizer and pesticide use on remaining cropland, however, the net reduction in fertilizer and pesticide use may be smaller than these estimates suggest.

Swampbuster

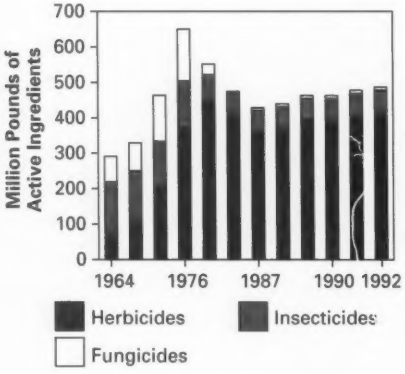
The 1985 Farm Bill took major steps to slow the loss of ecologically valuable wetlands in the United States. Producers who convert existing wet-

Agricultural chemicals.

Fertilizer use.



Pesticide use.



Source: See Part II, Table 53 and Table 54.

lands for crop production are disqualified from receiving USDA program benefits. The 1990 Farm Bill further refined wetlands provisions, making them easier to understand and enforce by changing the trigger for wetlands conversion from planting of an annual crop to the actual conversion of the wetlands. The legislation allows producers to mitigate wetlands loss through restoration of previously converted wetlands and also provides for graduated penalties. To date, the Soil Conservation Service has made 2 million determinations, delineating which areas are considered wetlands protected by the wetland conservation provisions of the 1985 Farm Bill.

Wetlands Reserve Program

The Wetlands Reserve Program (WRP), created by the 1990 Farm Bill, is similar to CRP in that it offers landowners financial incentives to restore and protect wetlands on their property. Landowners who grant long-term easements to restore and maintain wetlands receive easement payments, technical assistance, and up to 75 percent of costs for work approved to restore the wetlands. Landowners are then responsible for protecting and maintaining wetlands within the boundaries of the easement. WRP does not allow cropping or other alterations harmful to wetlands.

The Bush administration proposed full funding for the Wetlands Reserve Program at nearly $800 million through 1995 to restore and protect 1 million acres of wetlands. In fiscal 1992, with $46 million appropriated to enroll 50,000 acres, WRP began as a pilot program in nine states. During a sign-up held in July 1992, landowners offered 500,000 acres for enrollment in the pilot program.

Water Quality Incentives

The Agricultural Water Quality Incentives Program provides payments and technical assistance to landowners who reduce the movement of contaminants from cropland to surface and subsurface waters. As part of this pilot effort, USDA conducts research to improve conservation technology. The Department has selected 16 demonstration areas to show how economically sound agricultural practices can

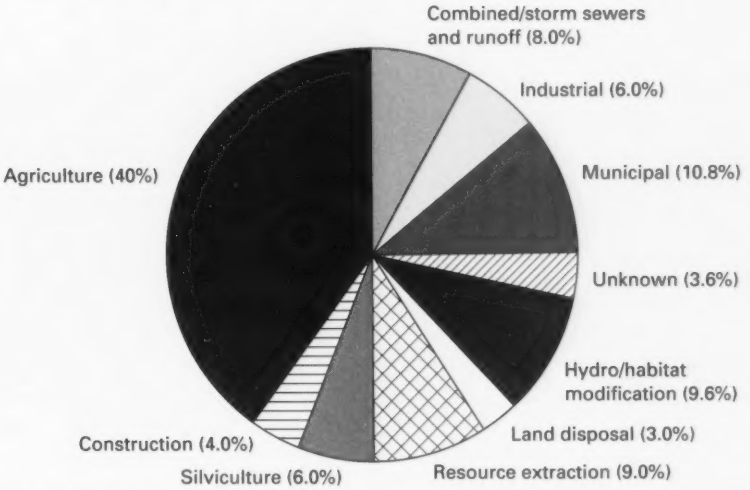
Fertilizer and pesticide use on major U.S. field crops.

Crop	Area planted	Area fertilized	Area treated with pesticides		
			Herbicide	Insecticide	Fungicide
	million acres				
Corn	60.4	58.5	57.6	19.3	–
Northern soybeans	38.9	10.1	37.5	–	–
Southern soybeans	10.8	3.9	10.0	–	–
Cotton	10.9	8.8	10.0	–	–
Winter wheat	34.2	28.7	–	–	–
Spring wheat	13.5	9.7	12.4	–	–
Rice	1.9	1.9	1.7	.3	.4

Note: Figures are for 1991.

Source: See Part II, Table 53.

Sources of pollution in U.S. rivers.



Note: Based on river miles monitored in 1990, which represent 9.5 percent of total U.S. river miles.

Source: See Part II, Table 31.

improve water quality. During fiscal 1991 a total of 1,679 producers used such practices on 163,000 acres of cropland. For example, better nutrient management reduced the application of nitrogen to cropland by 675,000 pounds and phosphorous by 216,000 pounds.

In addition, USDA has selected 74 areas for intensive action against specific nonpoint contamination problems. In these areas, farmers apply both existing and newly developed conservation practices to eliminate water quality problems, including those that involve

Agriculture in Concert with the Environment

Agriculture in Concert with the Environment (ACE) is a grant program sponsored by the U.S. Department of Agriculture and the Environmental Protection Agency. The program funds research, education, and demonstration projects to foster environmentally sustainable agriculture. In 1992 ACE awarded $2 million in grants for 27 projects with the following objectives:

- Prevent groundwater pollution from nutrients and pesticides,
- Prevent surface water pollution from livestock production operations, and
- Promote nonchemical pest control.

nitrogen, phosphorous, and pesticide use. In 1991 a total of 8,606 producers installed conservation practices on 390,000 acres of cropland with a resulting reduction of 1.8 million pounds of nitrogen and 1.5 million pounds of phosphorous. Cooperating agencies also assist with the improvement of pasture management in a number of these areas.

Windbreaks and Shelterbelts

Trees planted in windbreaks and shelterbelts protect agricultural crops, livestock, and rural farmsteads. In addition to reducing wind erosion, these trees save energy and improve water quality. Assisted by federal, state, and local programs, farmers have established, to date, 200,000 miles of windbreaks and shelterbelts in the United States, with an annual increase of 3,500 miles.

Management System Evaluation Areas

A joint research initiative on Management System Evaluation Areas (MSEAs), begun in 1991 by the Agricultural Research Service and the Cooperative State Research Service, helps control and reduce the impacts of agricultural chemicals on water quality. The U.S. Geological Survey has contributed to the effort by conducting geohydrologic site characterizations and research on the transport of selected pesticides and nitrates into groundwater at five locations in the Midwest.

Air Quality

Also see Energy, International Issues, Transportation, and related tables and figures in Part II.

As a world leader in air pollution control, the United States is moving toward air quality goals through the use of advanced technologies and innovative policies. However, in some parts of the nation, air pollutants continue to pose risks to human health and the environment. The Clean Air Act Amendments of 1990, a major achievement for air quality protection, were designed to achieve goals in a more flexible, cost-effective, market-based manner than was traditionally the case in the past.

Conditions and Trends

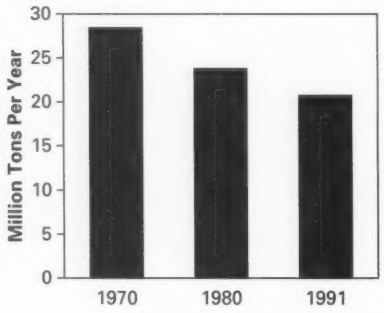
The United States made substantial progress in improving air quality nationwide during the 1980s. Monitors showed reductions in levels of six common pollutants for which the U.S. Environmental Protection Agency (EPA) has set health-based national ambient air quality standards.

The biggest success story from 1982-1991 was an 89-percent reduction in lead levels in the air, resulting primarily from the removal of lead from most gasoline. In addition, the gradual phase-in of cleaner automobiles and powerplants caused atmospheric levels of carbon monoxide to fall by 30 percent, nitrogen oxides by 6 percent, ozone by 8 percent, and sulfur dioxide by 20 percent. Levels of fine particulate matter (PM-10, otherwise known as dust and soot) have dropped 10 percent since the PM-10 standard was set in 1987.

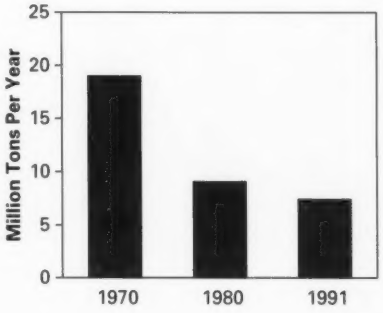
Despite this progress, 86 million people live in U.S. counties where pollution levels in 1991 exceeded at least one national air quality standard, based upon data for a single year. Urban smog continues to be the most prevalent problem; 70 million people live in U.S. counties where 1991 pollution levels exceeded the standard for ozone, the primary constituent of smog. Ozone pollution is formed from hydrocarbon and nitrogen oxide emissions, which come from motor vehicles and stationary sources such as factories, powerplants, and certain consumer products.

U.S. air pollution trends.

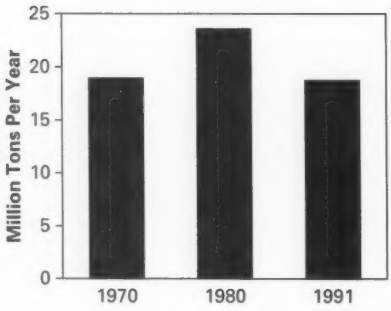
Sulfur dioxide emissions



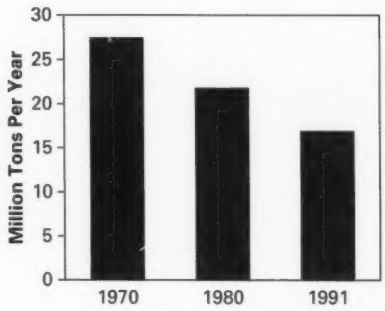
Total suspended particulates



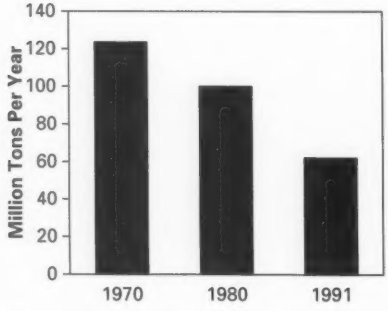
Nitrogen oxides emissions



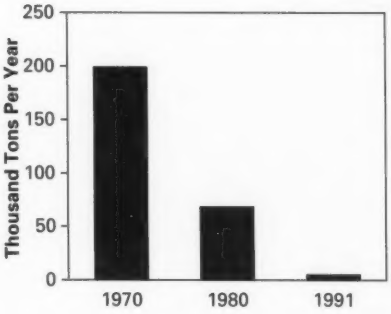
Volatile organic compounds



Carbon monoxide emissions

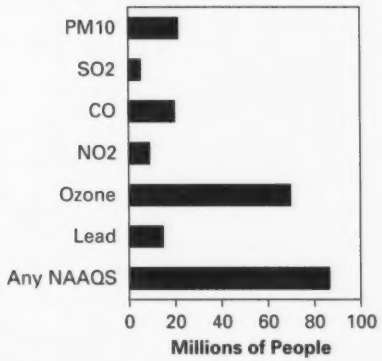


Lead emissions



Source: See Part II, Table 37.

People residing in counties that fail to meet Primary National Ambient Air Quality Standards (NAAQS).



Note: PM10 = particulate matter less than 10 micrometers in diameter (dust and soot). Numbers are for 1991 based on 1990 U.S. county population data. Sensitivity to air pollutants may vary from individual to individual.

Source: See Part II, Table 43.

Ozone can cause respiratory problems in sensitive individuals exposed for extended periods and also can damage forests and crops.

Carbon monoxide and particulates also exceed federal limits in some areas. Moreover, relatively large annual releases of sulfur dioxide and nitrogen oxides contribute to acid rain, visibility degradation, and health risks for sensitive parts of the population. Toxic pollutants—those known or suspected to cause cancer or other serious health effects—are released into the air in many areas. The latest EPA Toxics Release Inventory shows a total of 2.2 billion pounds of air toxics released nationwide in 1990.

Global Atmospheric Pollution

All over the world, air pollutants cross international borders and rise miles above the Earth's surface. For example, chlorine concentrations in the upper atmosphere resulting from the release of chlorofluorocarbons (CFCs) and certain other chemicals have increased to a level that damages the Earth's ozone layer, which shields the planet from harmful doses of solar radiation. Another concern is possible climate change due to the accumulation of greenhouse gases that trap heat in the atmosphere. Emissions of greenhouse gases are still growing, but the rate of increase has slowed over the last 20 years. With direct and indirect controls established on greenhouse gas emissions in the last four years, emissions are expected to rise by as little as 1-2 percent during the 1990s.

Indoor Air Pollution

The population's general exposure to indoor air pollutants is increasing because of the following factors:

- Construction of more tightly sealed buildings,
- Reduction of ventilation to save energy,
- Use of synthetic building materials and furnishings, and
- Use of chemically formulated personal care products, pesticides, and household cleaners.

Indoor air pollutants may include tobacco smoke, radon, volatile organic compounds, biological contaminants, combustion gases, respirable particulates, lead, formaldehyde, and asbestos. Scientific data is limited regarding exposures to and risks of indoor air pollution.

A focus of concern is radon, a naturally occurring gas that could be a leading cause of lung cancer in the United States. Although few homes have been tested (6 percent), federal and state

environmental agencies have detected elevated radon levels in some areas of every state.

Policies and Programs

Current U.S. policy on air quality is embodied in the Clean Air Act Amendments of 1990 (CAAA), which contain several innovative, market-based mechanisms to help reduce pollution. Major international initiatives include the U.N. Framework Convention on Climate Change, the Montreal Protocol on Substances that Deplete the Ozone Layer, and the U.S./Canada Bilateral Agreement on Air Quality.

Clean Air Act Amendments

When fully implemented, CAAA will reduce air pollutant emissions by 56 billion pounds annually. The amendments mandated significant air quality improvements:

- Attainment of air quality standards nationwide by the year 2010;
- Reductions in pollutants that cause acid rain, chiefly sulfur dioxide from coal-burning powerplants, by approximately 50 percent below 1980 levels by the year 2000;
- Reductions of toxic air pollutants by at least 75 percent;
- Cleaner cars, fuels, factories, and powerplants; and
- A phaseout of pollutants that threaten the stratospheric ozone layer.

Since passage of CAAA, EPA has proposed or finalized rules and guidance documents that together will accomplish more than three-quarters of the emission reductions called for under the act. In an effort to prevent the kind of hostile litigation that has delayed

Leading powerplant emitters of sulfur dioxides.

Source: U.S. Environmental Protection Agency, *National Air Quality Emissions and Trends Report, 1990,* (Washington, DC: EPA, 1991).

NAPAP: Research to Evaluate Policy

The Clean Air Act Amendments of 1990 reauthorized the National Acid Precipitation Assessment Program (NAPAP) to answer two questions:

- What are the costs, benefits, and effectiveness of Title IV of the Clean Air Act in reducing acid rain; and
- What reductions in acid deposition are necessary to prevent adverse environmental effects?

NAPAP addresses these questions and identifies research gaps on an interagency basis by forming expert working groups. The program currently emphasizes the following topics:

- Aquatic and terrestrial ecosystems,
- Human health,
- Materials,
- Visibility, and
- Monitoring and modeling of precursor emissions and changes in acid deposition in urban and non-urban areas.

environmental progress in the past, several rules were developed through regulatory negotiations and other forums in which industry, environmental groups, and state and local officials helped EPA develop regulatory proposals.

Market-Based Acid Rain Control

A prime example of the CAAA cost-effective, market-based methods is the acid rain control program, which employs an emission-allowance system to reduce annual nationwide sulfur dioxide emissions by up to 10 million tons per year, or roughly 50 percent below the 1980 level. Under this program, the federal government will allocate emission allowances to electric utilities whose powerplants emit sulfur dioxide. Nationwide emissions will be capped at the lower level and individual utilities must stay within their allowance limits. If, however, a utility can cut its emissions more than required, it can sell its extra allowances to another utility, or bank them for future use. This creates an economic incentive to the utility to maximize its emissions reductions at the lowest possible cost.

Initially, concerns with the market-based approach existed on two fronts. Some observers questioned whether a market actually would develop for the emission allowances, while others feared a lack of correspondence between the location of emission reductions and sensitive regions on the receiving end. Concerns over market development lessened substantially in 1992 when the Chicago Board of Trade established an allowance market; the first major transaction occurred in May 1992 when Wisconsin Power and Light sold 10,000 emission allowances to the Tennessee Valley Authority. Concerns over the distribution of pollution reductions have lessened because the cap on emissions will force all utilities to phase out older, dirtier equipment over time.

EPA has instituted a monitoring system to identify potential problem areas.

The following is a summary of other CAAA rules that EPA has proposed or finalized to date.

Cleaner Gasoline. National limits on gasoline's volatility—its tendency to evaporate—already are reducing the release of hydrocarbons, which contribute to ozone smog. Starting in 1995 a new generation of cleaner, reformulated gasolines will reduce hydrocarbon and toxic emissions by at least 15 percent in the nine cities with the worst ozone pollution. A companion rule to increase the oxygen content of gasoline in 39 cities with carbon monoxide pollution will cut those emissions by an estimated 20 percent in 1993.

Cleaner Cars and Trucks. Tighter emissions limits for cars and light trucks will be phased in starting with 1994 models, cutting exhaust hydrocarbons by 30 percent and nitrogen oxides by 60 percent relative to current standards. A new cold-temperature standard is expected to reduce wintertime carbon monoxide emissions by 20 percent. Smoke from diesel trucks and buses will be cut by proposed particulate standards and by new limits on sulfur in diesel fuel.

Vehicle Inspection and Maintenance. High-tech vehicle inspection and proper maintenance could do more to improve urban air quality than any other single measure. Under a rule issued in 1992, EPA will require improved vehicle emissions inspection programs in cities having difficulty attaining federal standards for ambient levels of ozone and carbon monoxide. The rule also requires vehicle owners to tune-up or repair high-polluting vehicles.

Cash for Clunkers. An estimated 20 percent of all vehicles on the road create more than 60 percent of auto-related air pollution. A proposed "cash for clunkers" program would allow states and industries to buy older, higher-polluting cars and trucks, retire them permanently, and use the resulting pollutant reductions to help satisfy federal clean air requirements. Several companies and organizations have conducted pilot tests of the program in conjunction with state and federal officials in California, Illinois, and Delaware.

Fleet Vehicles. Beginning in 1998 in 22 cities, EPA will require new fleet vehicles, such as taxis and delivery vans, to meet tailpipe standards more stringent than those required for conventional vehicles. EPA guidelines will provide incentives for fleet owners to purchase ultra-clean vehicles fueled with natural gas, propane, pure alcohol, or electricity.

Offshore Oil Facilities. Offshore oil and gas platforms within 25 miles of a state's seaward boundary will be subject to the same air pollution control requirements as onshore facilities.

Incinerators and Landfills. New standards for municipal waste incinerators will result in a 90-percent reduction in emissions of metals, organic chemicals, and acid gases. Proposed standards for large, solid waste landfills, as well as hazardous waste treatment and disposal facilities, would cut toxic and smog-forming emissions. The landfill standards also would cut releases of methane, a greenhouse gas.

Permits. To facilitate enforcement of the amendments, states will develop comprehensive permit programs for air pollution sources.

Hazardous Organics Rule. New standards cover emissions from such diverse sources as storage tanks, transfer operations, and wastewater treatment plants. As a result, toxic air

Cities with New Vehicle-Emissions Testing

Under a 1992 rule to enforce the Clean Air Act Amendments, the Environmental Protection Agency is requiring cities that have not met federal standards for ambient levels of ozone and carbon monoxide to improve inspection and maintenance (I/M) programs for vehicle emissions.

Basic I/M Programs. The following urban areas are required to initiate basic I/M programs:

Akron, OH	Grand Rapids, MI	Petersburg, VA
Ann Arbor, MI	Holland, MI	Port Arthur, TX
Aurora, IL	Huntington-Ashland,	Port Huron, MI
Beaumont, TX	WV-KY-OH	Richmond, VA
Charleston, WV	Joliet, IL	Round Lake Beach, IL
Dayton, OH	Lewiston-Auburn, ME	Sheboygen, WI
Denton, TX	Lewiston, TX	Springfield, OH
Elgin, IL	Muskegon, MI	Texas City, TX
Galveston, TX	Parkersburg, WV-OH	Toledo, OH-MI

Enhanced I/M Programs. Enhanced programs, required in areas with higher pollution, involve more sophisticated testing. Several cities with basic testing in place, are required to adopt the stricter program, such as New York, Atlanta, Philadelphia, Boston, Houston, San Diego, and Washington. The following metropolitan statistical areas are required to start enhanced I/M programs:

Albany-Schenectady-Troy, NY	Jamestown-Dunkirk, NY	Reading, PA
Altoona, PA	Johnstown, PA	Rochester, NY
Binghamton, NY	Lancaster, PA	Scranton-Wilkes Barre, PA MSA
Buffalo, NY	Manchester, NH	Sharon, PA
Burlington, VT	Niagara Falls, NY	State College, PA
Erie, PA	Orange County, NY	Syracuse, NY
Glen Falls, NY	Portland, ME	Tacoma, WA**
Hagarstown, MD	Portsmouth-Dover-	Utica-Rome, NY
Harrisburg-Lebanon-Carlisle, PA	Rochester, NH-ME	Williamsport, PA
	Poughkeepsie, NY	York, PA

**Tacoma is an urban area, not a metropolitan statistical area.
Source: U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Mobile Sources, November 1992.

pollutants will fall by 1 million pounds per year, and volatile organic compound emissions by 2 billion pounds per year.

Air Quality in National Parks. The CAA amendments also cover air quality and visibility in pristine areas, such as national parks. Many national parks are affected by pollution haze that can degrade scenic vistas for park visitors. Building on a 1991 agreement to cut utility emissions near Grand Canyon National Park, the Grand Canyon National Visibility Transport Commission began an assessment in 1992 of visibility conditions at several additional parks and wilderness areas in the West. Recommendations on measures needed to protect these and other scenic resources will be presented to EPA in 1995. Special efforts have been made to involve the public in the commission's activities.

Stratospheric Ozone Layer

To slow and eventually reverse ozone-layer depletion, the United States signed the 1987 Montreal Protocol, amended in 1990 in London and again in 1992 in Copenhagen. The Protocol calls for rapid elimination of chemicals that are damaging the ozone layer. In 1989 the United States imposed an excise fee on the production of chlorofluorocarbons (CFCs); the fee was increased by the Energy Policy Act of 1992. In 1990 the Clean Air Act Amendments required ozone-depleting substances to be phased out by the year 2000.

In February 1992, acting on scientific evidence that ozone depletion is occurring more rapidly and widely than previously believed, President Bush accelerated the U.S. phaseout deadline for CFCs to the end of 1995, four years ahead of the original Montreal Protocol deadline. To accelerate progress in the near term, the President asked U.S. producers voluntarily to cut 1992 output to half the 1986 levels. In response to the President's call for swifter international action, protocol signatories meeting in Copenhagen in November 1992 agreed to accelerate the international CFC phaseout deadline to the end of 1995.

Currently the United States is ahead of other nations in phasing out CFCs and has a world lead in developing safer substitutes. The nation is also the leading contributor to funds to assist developing nations in reducing reliance on ozone-depleting substances.

Clean Air Act Business Opportunities

Complying with the Clean Air Act Amendments will be costly for some industries and businesses. However, the amendments also create business opportunities.

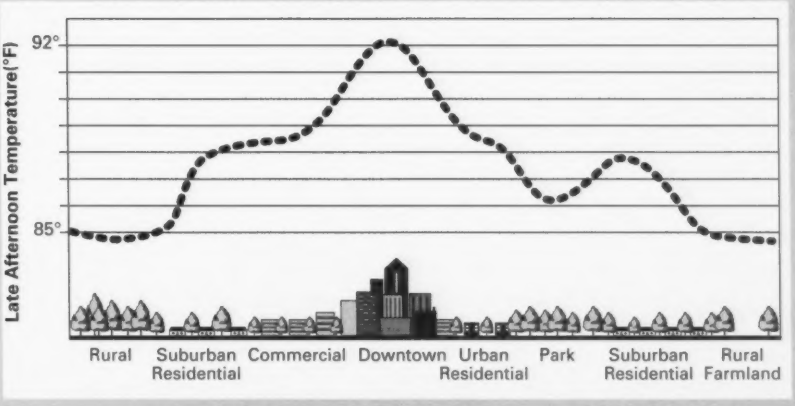
A study commissioned by the Environmental Protection Agency (EPA) projected that annual revenues to the air pollution control industry will grow by as much as $9 billion by 1996, with average annual growth of approximately 10 percent. Thousands of jobs may be created in the manufacture of air pollution control equipment. Enhanced vehicle inspection rules will generate jobs for inspectors, auto mechanics, and auto parts manufacturers. EPA also anticipates job shifting to such diverse fields as low-sulfur coal mining, chemical engineering for reformulated products, and manufacture of fuel additives and clean fuels such as natural gas and ethanol.

The Urban Heat Island Effect and Air Pollution

In urban areas, the mass of buildings, heat from cars and machinery, black asphalt of roads, and sparse tree cover combine to raise temperatures and slowly release heat back into the atmosphere. During the afternoon, city temperatures can be 6 degrees hotter than surrounding countryside. At night, city streets continue to radiate heat, keeping city temperatures 10 to 15 degrees warmer than the countryside. Studies have shown that this "urban heat island effect" aggravates air pollution and increases peak energy demand. The following strategies can help reverse the impact of the "urban heat island effect," and in so doing, cut energy bills and reduce air pollution:

- Select light colors for building exteriors and roofs to reflect rather than absorb sunlight,
- Use concrete or light-colored aggregate in asphalt for roads,
- Plant trees next to buildings to shade roofs, and shrubs to shade walls and windows,
- Shade exterior central air conditioning units to improve efficiency,
- Include natural shading in building energy codes,
- Plant trees to shade parking lots.

The Department of Energy, Environmental Protection Agency, USDA Forest Service, and American Forestry Association are cosponsoring a 2-year study to evaluate urban heat island effects and shade-related issues in 12 demonstration cities.



Source: U.S. Department of Energy, *Saving Energy by Managing Urban Heat Islands: Something We Can Do About the Weather,* (Washington, DC: DOE, 1991).

Greenhouse Gases

In June 1992 the United States signed the U.N. Framework Convention on Climate Change, a binding treaty designed to promote continuing domestic and international actions to address climate change. The U.S. Senate ratified the convention in October 1992, making the United States the first industrialized nation to ratify the treaty. The U.S. government has established a national climate action plan that includes the following elements:

- Measures to reduce greenhouse gases directly and indirectly and to enhance greenhouse gas sinks, such as forests;
- Development of new technologies to improve energy efficiency and reduce emissions; and
- The world's most extensive program of climate change research to better understand changes in the Earth's systems and develop appropriate responses.

Actions included in the U.S. action plan will reduce greenhouse gas emissions by an estimated 7-11 percent below levels otherwise projected for the year 2000. For more information on U.S. climate change policy, see the International Issues section.

Indoor Air Pollution

Within the U.S. government, 20 federal agencies have responsibilities associated with indoor air quality, either through statutory responsibilities or because they are major property managers. An interagency Committee on Indoor Air Quality (CIAQ) coordinates these activities and includes members from EPA, the Consumer Product Safety Commission, the Department of Energy, the National Institute for Occupational Safety and Health, and the Occupational Safety and Health Administration.

The federal government administers indoor air programs under the authority contained in several statutes. For example, Title IV of the Superfund Amendments and Reauthorization Act (SARA) requires EPA to conduct research and disseminate information. The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Toxic Substances Control Act (TSCA) authorize EPA to regulate products that adversely affect indoor air quality.

Among the indoor air pollutants being studied by federal agencies is radon. The U.S. Postal Service contracted with the DOE Oak Ridge National Laboratories to develop a sampling protocol to study radon in postal facilities. After conducting a sampling of postal buildings and evaluating new radon-detection technology, Oak Ridge scientists developed a sampling protocol and guidelines for the Postal Service radon program. The first phase of radon testing, which began in May 1992, focused on 40 postal facilities of different sizes throughout the nation.

Efforts by other federal agencies include research and dissemination of data on the following indoor air quality topics:

- Health effects,
- Building design and control techniques,
- Development of nonregulatory guidance on indoor air quality issues,
- Chemical screening to prohibit or restrict potentially harmful products,
- Radon testing, and
- Educational and outreach programs on health risks and prevention practices.

Biodiversity

Also see Forestry, International Issues, Private Sector Initiatives, and related tables and figures in Part II.

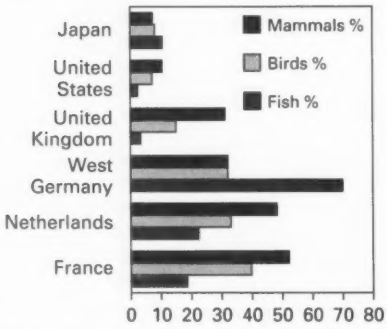
Biodiversity has been defined as the variety and variability of life—the diversity of genes, species, and ecosystems—but it is the interactions between these living components that are of primary concern. Diversity is essential for full ecological functioning. For example, genetic diversity better enables a species to survive changing conditions. Variation among species is the key to such basic ecological concepts as the food web. The rich variety of plant and animal species that exists on Earth is ultimately the source of much of the world's food, clothing, and shelter. Biological systems continually recycle air, water, and land. Humanity disrupts biodiversity at the risk of limiting its options and quality of life both now and in the future.

Conditions and Trends

Along with other nations, the United States lacks full and accurate information on the status and distribution of biodiversity components and the functioning of ecosystems. Most information available focuses on particular species, but a recognition is emerging regarding the value of data on ecosystems, communities, habitat, and genetic diversity. Even for species of current concern, such as those that are declining or near extinction or have special value for commerce or recreation, information is incomplete, and for thousands of species and plant and animal communities, existing status and trend information is anecdotal and sketchy. Although numerous sources of information are available, the following elements are lacking:

- A coordinated biodiversity data reporting or assessment effort;
- An overall scientific consensus on which statistics are most useful as biodiversity indicators and which procedures are most useful in comparing and managing biodiversity data.

Threatened species in relation to total species, by country.



Note: Based on environmental data from the Organization for Economic Cooperation and Development (OECD).

Source: Executive Office of the President, *U.S. Actions for a Better Environment,* (Washington, DC: U.S. Government Printing Office, June 1992), page 19.

The diverse global gene pool possesses the potential for vast economic value for humanity. Food products from wild species include fisheries, which in 1989 provided 100 million tons of food worldwide. Domesticated species account for 12-32 percent of gross domestic product (GDP) in countries around the world. In addition to providing timber, natural fibers, gums, and oils, nature is a major source of medicinal products for traditional medicine practiced by 80 percent of the people in developing countries. Diverse biota also fuel the development of modern pharmaceuticals. One quarter of all prescriptions dispensed in the United States contain active ingredients extracted from plants, and 3,000 antibiotics, including penicillin and tetracycline, are derived from microorganisms. Biodiversity also attracts recreation and tourism to unique sites throughout the nation and the world.

Policies and Programs

In 1992 federal agencies, the Congress, the states, and private organizations joined in efforts to sustain domestic and global biodiversity. A sampling of policies and programs follows.

National Biodiversity Center

In June 1992 the Bush administration announced its intent to establish a domestic center for biodiversity information. Interagency efforts are underway to develop such a center, whose basic functions would include the following:

Improving Access to Information. The center would serve as a mechanism to locate and provide access to biodiversity information in public and private institutions.

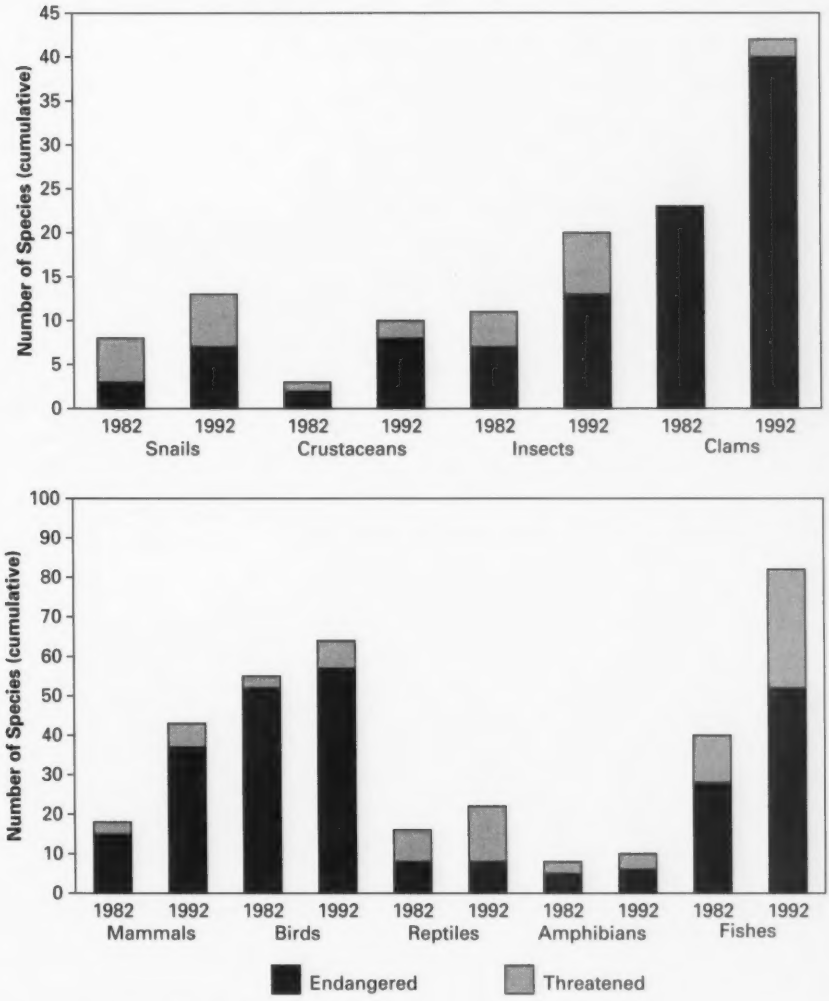
Assessing Biodiversity Information. The center would examine the current state of scientific information on biodiversity to identify gaps.

Improving and Standardizing Methodologies. The center would promote standard methods for data collection, reporting, and management, thus improving the comparability and utility of information.

Convention on Biological Diversity

In 1992 two years of intensive international negotiations concluded with a convention on biological diversity signed by 153 nations at the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro, Brazil. The convention requires measures to identify biological resources in decline, reasons for such declines, and on-site and off-site measures to address the declines.

U.S. species on the Threatened and Endangered Species Lists.



Source: See Part II, Table 87.

Although the United States participated actively in negotiations and hoped to be a signatory, the convention included several provisions, unrelated to the conservation sections of the treaty, that were unacceptable to the United States. These provisions concerned intellectual property rights, access to genetic information used in biotechnology, and international funding for biodiversity activities. As a result, the United States declined to sign the treaty in its present

U.S. Biodiversity: Trends in Key Species

Biodiversity monitoring data is available for a number of key species. Species data often is collected on an annual basis, whereas changes in ecosystem status generally are not. Recent CEQ annual reports addressed changes in ecosystem diversity, such as loss of tallgrass prairie, old-growth forest, and wetlands. Additional critical biodiversity issues include concerns over the effect of the widespread use of hatchery fish on the genetic diversity of wild fish.

Endangered Species. As of December 1992 the Fish and Wildlife Service (FWS) has classified 755 U.S. species of plants and animals as threatened or endangered. The Threatened and Endangered Species Lists, including foreign species, have a total of 1,284 species, and 3,964 species are candidates. The most recent (1990) assessment of recovery status for listed species revealed 38 percent declining, 10 percent improving, 31 percent stable, 2 percent extinct, and 19 percent of unknown status.

Ducks and Geese. Although estimated numbers of ducks migrating south in 1992 remained stable or showed an increase over recent years, the numbers are below long-term averages. By population estimates, 1992 was the sixth lowest year on record, even though breeding populations of three duck species showed a significant increase over 1991 figures, and populations were relatively stable for ten principal species. Estimates of goose populations, based on less rigorous information than for ducks, indicate that despite recent declines, most goose populations are at or above normal levels. An exception is Atlantic flyway Canada geese, which declined to their lowest level in 23 years.

Raptors. Fall 1991 and spring 1992 surveys of raptors showed large declines in counts of sharp-shinned hawks, one of the most abundant of the eastern raptors. The cause of the decline is unknown. Osprey, Cooper's hawk, merlin, and peregrine falcon—several of which are thought to have been affected by the now-banned pesticide DDT—apparently are recovering.

Pacific Salmon. In late 1991 the American Fisheries Society (AFS) classified 214 native, naturally spawning stocks of Pacific salmon, steelhead, and sea-run cutthroat trout as being at high risk of extinction (101 stocks), at moderate risk of extinction (58), or of special concern (54). One stock was already listed under federal and State of California endangered species laws, and during 1992, three Columbia River stocks were listed. AFS indicated that 18 of the classified stocks may already be extinct, and that 106 other major West Coast salmonid populations have also become extinct.

form. At the Rio meeting, however, President Bush stated that U.S. efforts to conserve domestic biodiversity will exceed the requirements of the treaty.

The United States conducts several programs for worldwide biodiversity research and conservation through the U.S. Agency for International Development (USAID) and the international forestry programs of the USDA Forest Service. The Biodiversity Support Program, a joint venture by USAID, the World Wildlife Fund, The Nature Conservancy, and the World Resources Institute, provides expertise on biodiversity around the world. A USAID/National Science Foundation collaborative program supports research and education in developing countries on potential threats to ecosystems and species.

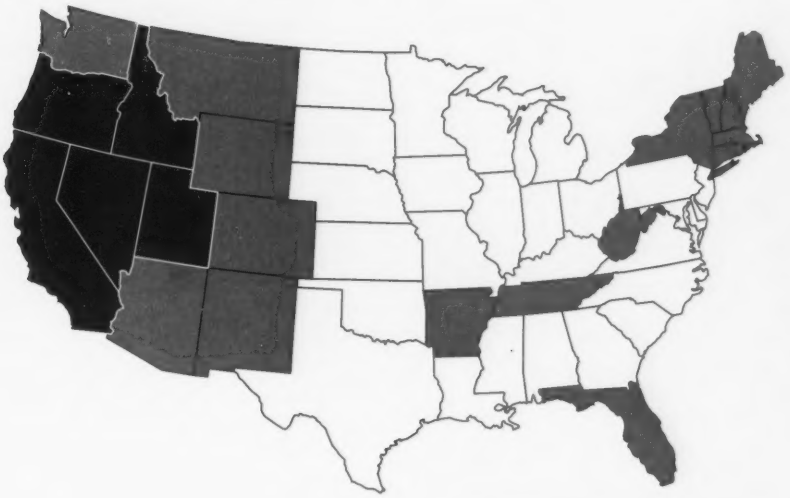
Inventory and Research Proposal

At UNCED, the United States offered a proposal to foster international scientific cooperation on biodiversity surveys, inventories, and data management, with the goal of increasing the availability, comparability, and quality of information on biological diversity. The United States plans to host a meeting in early 1993 of international experts to consider topics such as data-gathering and reporting standards, approaches to conducting inventories and surveys, data management techniques, and institutional issues related to national biodiversity surveys.

Gap Analysis

Fish and Wildlife Service researchers use satellite imagery, habitat data, and geographic information systems to compare the distribution of species and plant/animal communities with existing land use and land management patterns. From this analysis, they can begin to assess current protection and identify areas in need of greater

Gap analysis projects, by state.



Source: U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC, 1992.

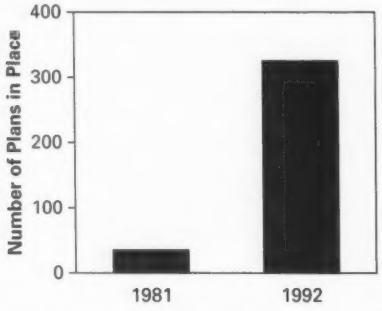
protection. In 1992 federal, state, and private organizations worked on gap analysis projects in 22 states. Nationwide coverage is planned.

Endangered Species Protection

Biodiversity conservation includes efforts to preserve the diversity of species and the ecosystems on which they depend. Foremost among such U.S. efforts is the Endangered Species Act (ESA), whose initial stated purpose is "to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved." Despite this broad mandate, most implementation efforts focus on protecting individual species in danger of extinction (endangered) or likely to become so in the foreseeable future (threatened).

The federal agencies that implement ESA—Fish and Wildlife Service (FWS) for terrestrial and some aquatic species and National Marine Fisheries Service (NMFS) for marine species and anadromous fisheries—have begun to increase the use of regional and multi-species, habitat-based approaches. For example, FWS emphasizes additions to threatened and endangered species lists that cover multiple species in a given region, so that conservation efforts can address their various needs more efficiently. FWS also supports multi-species recovery actions.

Threatened and endangered species recovery plans, in place.



Source: U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC, 1992.

In a landmark decision to accelerate ESA implementation, FWS in December 1992 reached a legal settlement with environmental groups by agreeing to propose for listing within four years the 400 highest-ranked candidate species. In addition the service consented to expedite final consideration of 900 species that it believes may be worthy of protection but for which it does not have definitive scientific information. This settlement will create additional momentum for multi-species, habitat-based conservation approaches.

ESA allows the taking of listed species—defining "take" to include "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage"—if the activity is incidental to an otherwise legal activity and after approval of a habitat conservation plan demonstrating that the taking will not appreciably reduce the likelihood of survival or recovery. Such plans often cover a significant portion of the habitat for a species and thus have the potential to provide protection for a range of species and plant/animal communities. As of October 1992 FWS and NMFS had issued 20 incidental-take permits and 17 permit amendments. FWS staff had provided pre-application technical assistance on 52 habitat conservation plans.

In 1991 the BLM director invoked a section of ESA that allows a cabinet-level committee to authorize a project that would jeopardize a species. This group, known as the Endangered Species Committee, convened in late

Linking Ecosystems and Biodiversity

In June 1992 the Bureau of Land Management (BLM) in the Department of the Interior and the USDA Forest Service jointly adopted a philosophy of ecosystem management that includes the following elements:

- Managing lands and waters to restore and sustain biodiversity and productivity of renewable natural resources;
- Developing conservation partnerships and improving the participation of citizens in public resource decisionmaking; and
- Bringing the scientific community into stronger partnerships with land managers.

Ecological land management is based on the following principles:

- Protecting or restoring the integrity of soils, air, water, biodiversity, and ecological processes;
- Meeting the basic needs of people and communities who depend upon the land for food, fuel, shelter, livelihood, recreation, and spiritual renewal;
- Promoting efficiency by ensuring cost-effective production of natural resources; and
- Working to meet the needs of a variety of interests, regions, and generations in land-use decisionmaking.

In 1992 the departments of Agriculture and the Interior issued *America's Biodiversity Strategy: Actions to Conserve Species and Habitat,* which discusses the framework for managing species and protected areas that has evolved over the past century. Public land managers, scientists, and the public increasingly take an ecosystem approach to specific situations found in the various parts of the country. For example, BLM has developed a proposal for managing 2.5 million acres of federal land in western Oregon that incorporates biodiversity and sustainable development. An environmental impact statement released in August 1992 contains an analysis of the proposal.

1991 and in May 1992 reached a decision to allow some of a number of disputed timber sales to proceed. (For more information, see the Forestry section.)

Natural Community Conservation Planning

In 1992 the State of California continued an innovative program of Natural Community Conservation Planning (NCCP) to anticipate and prevent controversies resulting from listing of species under federal or state endangered species laws. The goal is to protect entire ecosystems while allowing compatible economic development. The program works through voluntary, permanent, enforceable conservation strategies that address specific habitats and species, setting out protected areas and areas appropriate for development.

The Dow Chemical Co.

Natural ecosystems, such as this wetlands, provide habitat for an array of wildlife species.

A pilot program is underway to address coastal sage scrub, a habitat type supporting several potentially endangered or threatened species, including the California gnatcatcher. Private landowners have agreed to forestall development on 141,000 acres, some of which contains coastal sage scrub, for an 18-month period, while final conservation plans are developed. During this period, public land-use and regulatory agencies will increase their discretionary review of projects on 1.1 million acres, containing 210,000 acres or 53 percent of the identified sage scrub habitat. Development of the conservation plans involves landowners, local governments, and state and federal wildlife agencies.

California Bioregions

The State of California, in cooperation with federal agencies, began a groundbreaking effort in 1991 to reorient existing environmental and natural resource management efforts around natural ecological regions or bioregions. The first major activity of the effort was a report released in 1992 on the Sierra bioregion. The Sierra Report, based on a broad public outreach effort, contained 18 recommendations for increasing public understanding of the effects of human activities on the bioregion. The effort involved local communities in decisionmaking and recognized the linkage between environmental and economic concerns.

Every Species Counts

The USDA Forest Service has adopted landscape and ecosystem approaches to managing habitat for 230 threatened or endangered species. In 1992 the agency surveyed 1 million acres for threatened, endangered, and sensitive species (a Forest Service designation). The agency is preparing species management guides for the 50 states, in conjunction with such groups

as The Nature Conservancy, which assist with inventory, data management, and development of conservation strategies. Examples of activities during 1992 follow.

- Release of two captive-bred California condors and two Andean condors into historic condor habitat in California;
- Placement of 450 nest boxes for the hurricane-ravaged red-cockaded woodpecker in South Carolina national forests, which contributed to a 9-percent increase in woodpecker populations;
- Careful use of fire to restore specialized forest ecosystems, such as southern pine stands that host red-cockaded woodpeckers, tallgrass prairie in Illinois, and mountain golden heather in North Carolina; and
- Development in the Southwest of management guidelines for the northern goshawk, adopting an ecosystem approach that benefits other species as well.

Bring Back the Natives!

Non-indigenous (exotic) species have invaded or been introduced to many areas of the country, where they often disturb natural ecosystems. In 1992 the Forest Service, BLM, and the National Fish and Wildlife Foundation (a Congressionally chartered nonprofit organization) cooperated on 18 Bring Back the Natives projects. This national effort attempts to restore the health of entire stream systems and their native aquatic species, including fish, mollusks, and plants. On public lands, restoration of entire watersheds can make a critical difference in the recovery and conservation of vulnerable species.

Pacific Salmon and Steelhead Conservation

In 1992 the USDA Forest Service initiated a strategy to provide an ecological approach to managing salmon and steelhead habitat in western national forests. The strategy will identify and implement measures that contribute to the sustained natural production of salmon and steelhead stocks, possibly precluding the need for listing under the Endangered Species Act. The Forest Service is coordinating development and implementation of the strategy with other fish management agencies and conservation groups.

Biodiversity and NEPA

In 1992 CEQ, with support from EPA and the departments of the Interior, Agriculture, Defense, and Transportation, completed a series of conferences on ways to incorporate biodiversity and ecosystem management into analyses prepared under the National Environmental Policy Act (NEPA). A CEQ report will outline recommendations for accomplishing this objective.

Biodiversity on Private Lands

Since the majority of lands in the United States are in private ownership, any national strategy to conserve biodiversity must find ways to encourage conservation actions by private landowners. In 1992 the President's Commission on Environmental Quality (PCEQ) undertook an initiative to develop best practices for integrating biodiversity considerations into private land management decisionmaking. The initiative involves case studies of 16 demonstration projects proposed by private firms, ranging from 100 acres on a suburban Philadelphia corporate cam-

pus to 280,000 acres of a forested and mixed-use watershed on the coast of Washington state. A PCEQ report will present case studies and best-practice recommendations along with outreach materials that offer guidance for private landowners.

International Trade in Endangered Species

The eighth conference of the parties to the Convention on International Trade in Endangered Species (CITES) took place in Japan in March 1992. Delegates agreed to continue the African elephant's listing on Appendix I, which bans all trade in ivory. They discussed the listing of commodity species such as blue fin tuna and several tropical timber species, including varieties of mahogany. Although blue fin tuna was not listed, several varieties of mahogany were, and delegates agreed to reevaluate the scientific criteria for CITES listing.

In 1992 the Congress, with the support of the Bush administration, enacted new legislation to facilitate U.S. implementation of decisions and resolutions under CITES with regard to exotic birds. The new legislation authorizes regulation of imports of exotic wild birds, whose populations may be adversely affected by trade. It also authorizes the Secretary of the Interior to support wild bird management efforts in other nations.

Caribbean Regional Treaty

In 1992 the Bush administration sent to the Senate for ratification the Protocol Concerning Specially Protected Areas and Wildlife. This protocol builds upon general obligations outlined in the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region, which calls upon signatories to establish protected areas to conserve rare or fragile ecosystems as well as habitats for threatened and endangered species.

C. Pelescak.

The endangeed Florida panther depends on a healthy Everglades ecosystem for its survival.

Neotropical Migratory Birds

Partners in Flight/Aves de las Americas is a cooperative program that involves state, federal, and international agencies and conservation organizations. It is the first integrated program for research, monitoring, and habitat management for migratory birds—neotropical migrants—that breed in North America and migrate to Latin and South America during the northern winter. In 1992 the program sponsored a national workshop on the status of such birds as the indigo bunting, scarlet tanager, and many species of warblers and the effect of land-use practices on their long-term survival. Initiatives focused on bird population management, habitat monitoring, habitat improvement, training, and public education.

Marine Sanctuaries

The NOAA National Marine Sanctuary Program aims to conserve and protect habitats and associated biological communities necessary to sustain living marine resources. It also provides opportunities for research. In 1992 Monterey Bay off the central California coast and the Florida Garden Banks off the Texas-Louisiana border were added to the National Marine Sanctuary system. These additions brought the number of marine sanctuaries to 13 and more than doubled the size of the system.

Estuarine Research Reserves

The goal of the National Estuarine Research Reserves Program is to establish and manage a system of estuarine research areas representative of the various U.S. biogeographical regions and estuarine types. In 1992 the Ashepoo-Combahee-Edisto (ACE) Basin and North Inlet/Winyah Bay reserves were designated in South Carolina, bringing the total number of reserves to 21.

Research Natural Areas

Research natural areas (RNA) are areas of forest, range, aquatic, geologic, alpine, shrubland, and grassland vegetation set aside for nonmanipulative research, study, monitoring, and education. In 1992 the Forest Service reviewed 300 sites for addition to the system. Established in 1927, the RNA program now encompasses 290 sites and 250,000 acres.

Biosphere Reserves

Biosphere reserves provide a framework for regional and international cooperation in biodiversity conservation and research. The U.N./U.S. Man and the Biosphere Program (MAB) has initiated interdisciplinary research on ecosystem sustainability in biosphere reserves in New Jersey, Virginia, and Florida. In 1992 UNESCO designated The Land Between the Lakes, a demonstration area for integrated management in Kentucky and Tennessee administered by the Tennessee Valley Authority, as the forty-seventh U.S. biosphere reserve. A Biosphere Reserves Integrated Monitoring Program (BRIM), launched under the auspices of EuroMAB, is promoting cooperation among European and North American biosphere reserves. Among the first BRIM efforts is documentation of biodiversity in the reserves.

Biodiversity Education

Federal agencies have undertaken a number of initiatives to inform the public and to train professional staffs on the principles of biodiversity conservation.

National Park Service. NPS has launched a national program to promote public awareness of biodiversity management issues and the value of biodiversity to human societies. In 1992 efforts included a comprehensive manual for interpreters and a range of media used in educational programs at many national parks and monuments.

Forest Service. The Forest Service Natural Resource Conservation Education program supports lifelong learning about natural resources and ecosystems, their interrelationships, conservation, use, management, and value to society. In 1992, the program's first full year, the Forest Service committed $2.5 million to 150 education projects, including the following: development of curricula for elementary and secondary schools; use of national forests and grasslands as

living classrooms; support for individual teachers; events promoting environmental awareness; and development of local and statewide strategic plans for conservation education. Through partnerships with other federal, state, and local agencies, schools, and private industry, the Forest Service was able to double funding for biodiversity education.

Bureau of Land Management. BLM, along with other federal agencies, held the first session of a field training course that applies principles of ecosystem management to field activities to conserve biodiversity.

Biodiversity Symposium

In July 1992 the USDA Forest Service held an international symposium, "Biodiversity in Managed Landscapes: Theory and Practice," in Sacramento, California. Public and private organizations, including a number of federal agencies, were cosponsors. The symposium, attended by 400 people from 12 countries, had the following objectives:

- Document case examples of biodiversity theory and concepts applied at differing scales, such as local, national, and global;
- Examine policies that affect biodiversity conservation;
- Emphasize that the conservation of biodiversity requires more than a network of protected areas and preserves; and
- Provide a forum for dialogue and interchange that will lead to increased understanding and cooperation.

Coasts and Oceans

Also see Fisheries and Marine Mammals, International Issues, Wetlands, and related tables and figures in Part II.

Coasts and oceans contribute significantly to the nation's economy, and to the quality of life for Americans. The coastal zone deserves protection for a variety of reasons:

- Aesthetic and recreational offerings;
- Critical ecological functions such as protection of water quality and protection from flood and storm damage; and
- Economic activities such as fishing, tourism, and commerce.

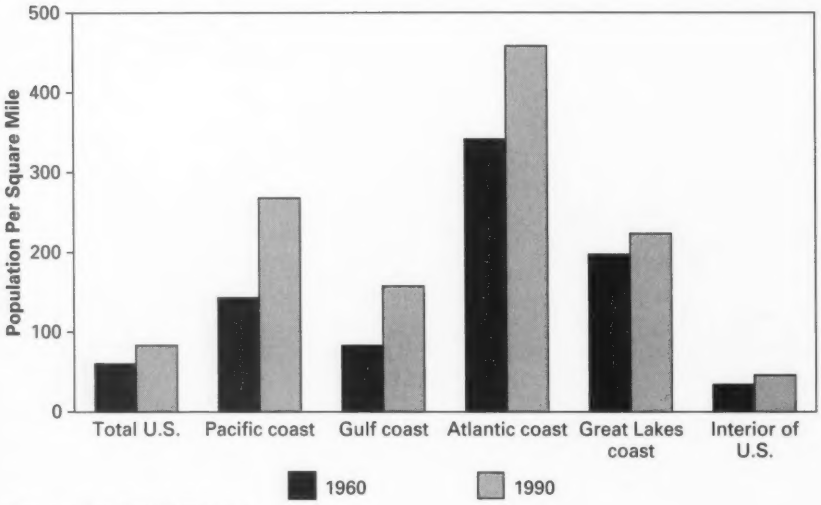
Conditions and Trends

The vast reaches of the oceans are relatively clean and healthy primarily because of their enormous volume and capacity for dilution. However, the edges of the oceans—the coastal waters—are subject to the disruptive impacts of human endeavors. These include the consumption of resources, disposal of wastes, and alteration of shores for social and economic benefits. A 1990 assessment by the Environmental Protection Agency (EPA) of 26,693 estuarine coastline miles and 4,320 ocean coastline miles revealed that only 56 percent of estuarine waters fully support designated uses such as swimming and fishing, while 89 percent of coastal ocean waters fully support designated uses. Only 2 percent of Great Lakes coasts assessed in the study support designated uses.

Population Pressures

As defined by the National Oceanic and Atmospheric Administration (NOAA), the U.S. coastal zone is comprised of the 666 coastal counties, cities, boroughs, or other county equivalents within 50 miles of ocean, bay, sound, or Great Lakes coasts. Excluding Alaska, U.S. coastal counties support nearly half of the nation's population while accounting for only 11 percent of the land mass. NOAA studies anticipate a 15-percent increase in coastal population over the next two decades, concentrated in California,

Changes in U.S. population density.



Source: See Part II, Table 6.

Florida, and Texas. Coastal population density increased from 248 people per square mile in 1960 to 341 in 1988, more than four times the national average.

Multiple Use

Varied interests use coasts, oceans, and their associated resources in a multitude of ways:

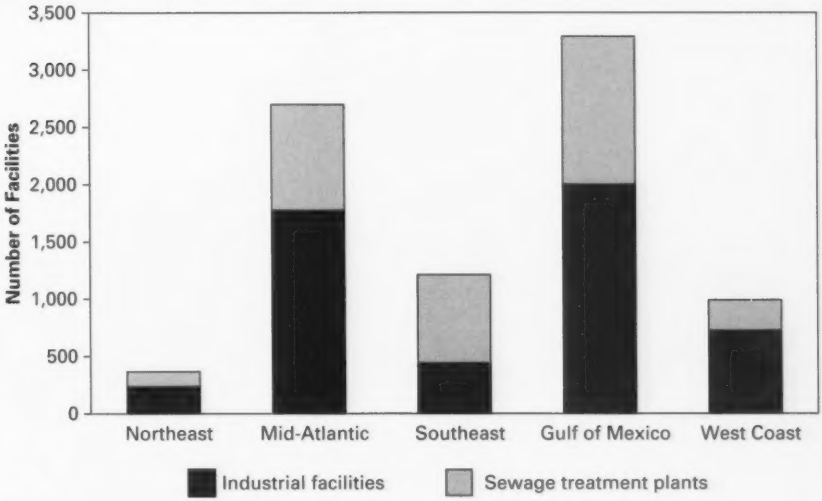
- Commercial fishing;
- Marine transportation;
- Oil, gas, and other extractive activities;
- Recreation;
- Residential development;
- Federal, state, and local government operations;
- Activities of Native American tribes and of the general public.

The multiple demands placed on the coastal zone, combined with increasing population density, reflect the zone's high economic value and contribution to the nation's quality of life. For example, coastal recreation alone represents significant expenditures. Recreational fishermen spent an estimated $6.2 billion in 1985, and recreational boaters spent $17.1 billion in 1989. An estimated 94 million people participate annually in coastal boating and fishing. At the same time, the multitude of uses concentrates pressure on coastal resources and processes.

Coastal Pollution

Pollution stress results from activities in and adjacent to coastal waters. Oil spills and waste discharges from boats, industrial facilities, and municipal wastewater treatment plants are direct sources of pollution. Activities occurring throughout watersheds that drain to coastal waters provide indirect sources of pollution in the form of point-source discharges into rivers. Nonpoint sources such as runoff from agricultural or urban areas carry nutrients, chemical pesticides and herbi-

Point source dischargers to U.S. coastal waters.



Note: Data are for mid-1980s.

Source: U.S. Department of Commerce NOAA, *Estuaries of the United States,* (Washington, DC: NOAA, 1990.)

cides, and increased sediment loads resulting from development.

Coastal pollution has its greatest impacts on recreational use, fish and shellfish, and wildlife habitat values. Residents and recreationists in many coastal areas continue to experience beach closures because of unsafe levels of fecal coliform bacteria or marine debris. Other problems include fish and shellfish consumption advisories, shellfish bed closures, and diminished aesthetic quality. The viability of 75 percent of the nation's commercial fisheries depends on clean and functioning estuaries. Pollution and physical alteration may render coastal habitats incapable of providing elements critical to the life cycles of many fish and shellfish.

Coastal Hazards

As coastal development increases, so do potential threats to life, property, and natural resources, resulting from coastal hazards—natural and human-induced. Flooding, high winds, tsunamis, coastal erosion, sea level rise, and storm surges associated with hurricanes and typhoons are all of concern to coastal planners, managers, and residents. The need to protect natural features such as wetlands, mangroves, dunes, and coastal barrier islands is reinforced each time the nation experiences the destructive forces of hurricanes such as Hugo (South Carolina, 1989), Andrew (south Florida and Louisiana, 1992), and Iniki (Kauai, Hawaii, 1992).

Improvements in the ability to predict the severity and landfall of coastal storms have resulted in far fewer injuries and deaths resulting from these events. However, even as storm-related mortality decreases, the costs of storm damage to heavily developed and rapid-

Deadliest hurricanes of the century.

Hurricane	Location	Year	Deaths
—	Galveston, TX	1900	6,000 +
—	Lake Okeechobee, FL	1928	1,836
—	Florida Keys and south TX	1919	600 *
—	New England	1938	600
—	Florida Keys	1935	408
Audrey	Southwest LA and northern TX	1957	390
—	Northeastern USA	1944	390 **
—	Grand Isle, LA	1909	350
—	New Orleans, LA	1915	275
—	Galveston, TX	1915	275

* Over 500 persons lost on ships at sea; 600-900 estimated deaths.
** Some 344 persons lost on ships at sea.

Note: Information does not include Hurricane Iniki. The National Hurricane Center began naming hurricanes in 1950.

Source: U.S. Department of Commerce, NOAA National Hurricane Center, Miami, FL, 1992.

Costliest hurricanes of the century.

Hurricane	Location	Year	Damage *billion 1990 $*
Andrew	South FL and LA	1992	25-30.00
Hugo	Charleston, SC	1989	7.15
Betsy	FL and LA	1965	6.46
Agnes	Northeastern USA	1972	6.41
Camille	MS and AL	1969	5.24
Diane	Northeastern USA	1955	4.19
—	New England	1938	3.59
Frederic	AL and MS	1979	3.50
Alicia	Northern TX	1983	2.39
Carol	Northeastern USA	1954	2.37

Note: Adjusted to 1990 dollars on basis of U.S. Department of Commerce composite construction cost indexes. Information does not include Hurricane Iniki.

Source: U.S. Department of Commerce, NOAA National Hurricane Center, Miami, FL, 1992.

ly developing coastal areas increase. Damages from Hurricane Andrew could reach $30 billion, making it the most expensive natural disaster in U.S. history.

Oceans. The world's oceans are under stress, with their productive and regenerative capacity threatened by pollution and over-utilization of marine resources. In contrast to coastal regions, the open sea remains relatively clean. Lead, synthetic organic compounds, and artificial radionuclides are widely detectable but at low levels. The oil slicks and litter common along sea lanes remain, for the most part, of minor

consequence to communities of organisms living in the open-ocean areas.

Programs and Policies

Several federal agencies share responsibility for coastal and ocean issues. NOAA (Department of Commerce) and the Fish and Wildlife Service (Department of the Interior) are responsible for stewardship of living marine resources. NOAA, EPA, FWS, the Minerals Management Service (Department of the Interior), the National Science Foundation (NSF), and the Navy are all active in marine-related scientific research. Navigational safety and national security are covered by NOAA, the Army Corps of Engineers, the Navy, and the Coast Guard, while offshore minerals development is primarily the responsibility of MMS. EPA is the lead agency responsible for the regulation of pollution sources, and NOAA and the Coast Guard also address coastal marine pollution.

Planning and Management

Programs to manage the nation's coasts and oceans are mandated by federal laws, including the Coastal Zone Management Act Amendments of 1990 (CZMA) and the Clean Water Act (CWA).

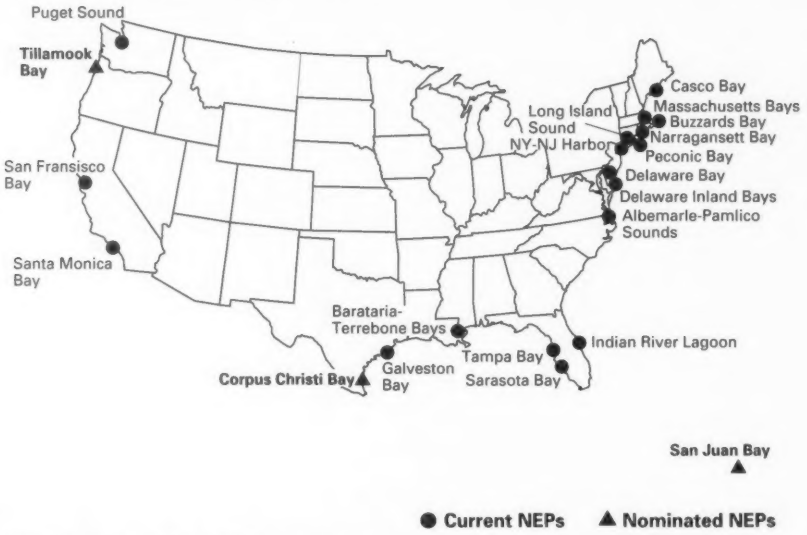
Coastal Zone Management. The Coastal Zone Management Program, authorized by CZMA, is administered primarily by NOAA. Through a federal-state partnership, states with federally approved Coastal Zone Management (CZM) plans are eligible for federal grants and technical assistance to manage their coastal resources. Presently 29 of the 35 U.S. coastal states and territories have approved CZM programs that cover 94 percent of the U.S. coastline (84,117 miles). Texas, Ohio, Minnesota, and Georgia are in the process of developing CZM programs, and presently, the Great Lakes states of Illinois and Indiana do not participate in the program. In 1992 the majority of participating states prepared assessments and strategies to address priority coastal enhancement in such areas as natural hazards, shoreline access, wetlands, marine debris, ocean resources, special area management planning, government facility siting, and cumulative and secondary impacts of development.

Nonpoint Source Pollution. The CZMA Amendments of 1990 require participating coastal states to develop Coastal Nonpoint Pollution Control Programs subject to approval by NOAA and EPA. Nonpoint source pollution is now believed to contribute more to water quality degradation than point sources. Nonpoint pollution programs will need to focus on the following sources of water pollution that impair or threaten U.S. coastal waters:

- Agricultural runoff;
- Urban runoff;
- Silvicultural (forest management) runoff;
- Marinas;
- Recreational boating; and
- Hydromodification such as dams, levees, and shoreline erosion.

Geographic Initiatives. In response to the multiple demands placed on coastal resources, coastal managers increasingly base data collection and management programs on ecologically determined geographic units such as drainage basins, estuaries, or ecosystems. The geographic approach considers the full range of factors that contribute to resource degradation.

National Estuary Program (NEP) sites.



Note: The National Estuary Program develops Comprehensive Conservation and Management Plans (CCMPs) to restore threatened estuaries; data are current as of October 22, 1992.

Source: U.S. Environmental Protection Agency, Washington, DC, 1992.

Such an approach requires the collaboration of public and private groups to balance multiple values.

For example, the EPA National Estuary Program is a partnership established by section 320 of the Clean Water Act that identifies nationally significant estuaries threatened by pollution, development, or overuse. Comprehensive Conservation and Management Plans (CCMPs) identify management options designed to restore targeted estuaries. Federal, state, regional, and local authorities as well as affected industries, academic institutions, and citizens take part in developing CCMPs. The program currently has 21 estuaries with plans under development, 4 of which were added in 1992. Following approval in 1991 of the first CCMP, which covered Puget Sound, Washington, EPA approved a CCMP for Buzzard's Bay, Massachusetts, in 1992.

Other EPA geographic initiatives, such as the Chesapeake Bay Program, Great Lakes Program, and Gulf of Mexico Program target coastal resources. The Near Coastal Waters Program helps EPA identify priority coastal areas and integrate protective efforts by addressing gaps in coastal management.

Coastal Protection

NOAA and various Department of the Interior agencies manage programs to protect coastal resources.

National Marine Sanctuaries. The Marine Protection, Research, and Sanctuaries Act of 1972 provides for the protective management of unique marine recreational, ecological, histori-

cal, research, educational, and aesthetic resources through designation of National Marine Sanctuaries (NMS). Managed by NOAA, these select areas are the marine equivalent of national parks. In 1992 the United States doubled the area protected by this program with establishment of four new sanctuaries: the Flower Garden Banks sanctuary in the Gulf of Mexico, the Monterey Bay sanctuary off the coast of California, the Stellwagen Bank sanctuary off the coast of Massachusetts, and the Hawaiian Islands Humpback Whale sanctuary off the Hawaiian Islands. The Monterey Bay sanctuary, which encompasses 4,024 square nautical miles, is second only to Australia's Great Barrier Reef as the largest marine protected area in the world. The total area now protected under the National Marine Sanctuaries Program is over 9,000 square nautical miles.

Estuarine Research Reserves. NOAA also protects 425,000 estuarine acres through the National Estuarine Research Reserves System established by CZMA. In 1992 a total of 144,000

National marine sanctuaries.

Marine sanctuary	Designation date	Location	Size	Description
			square nautical miles	
Monitor	1975	Cape Hatteras, NC	1.0	A circular area over the wreck of the *U.S.S. Monitor.*
Key Largo	1975	Upper Florida Keys	100.0	Coral reef.
Channel Islands	1980	Santa Barbara, CA	1,252.0	Offshore, nearshore, and intertidal habitats.
Gray's Reef	1981	Sapelo Island, GA	17.0	Submerged live-bottom reef.
Gulf of the Farallones	1981	Along the central California coast	948.0	Diverse habitat for marine mammals and seabirds.
Looe Key	1981	Lower Florida Keys	5.3	Florida reef tract.
Fagatele Bay	1986	Tutuila Island American Samoa	0.2	Terraced coral reef ecosystem typical of South Pacific islands.
Cordell Bank	1989	San Francisco, CA	397.0	Ocean waters surrounding a submerged mountain top.
Florida Keys	1990	Off the Florida Keys	2,800.0	Coral reefs and other waters.
Monterey Bay	1992	Along the central California coast	4,024.0	Marine mammals, seabirds, and the largest U.S. submarine canyon.
Flower Garden Banks	1992	Off the Texas-Louisiana coast	41.7	Northern-most North American coral reef community.
Stellwagen Bank	1992	Off the coast of Massachusetts	638.0	Whale summering ground, major fisheries.
Hawaiian Islands Humpback Whale	1992	Off the Hawaiian Islands	500.+	Whales and tropical coral reef resources; final boundaries remain to be designated.

Source: U.S. Department of Commerce, NOAA, National Ocean Service, 1992.

National estuarine research reserves.

Note: Estuarine reserves are protected areas set aside for research; data are current as of September 1992.

Source: U.S. Department of Commerce, NOAA National Marine Fisheries Service, Silver Spring, MD, 1992.

acres was added to the system with final designation of the ACE-Basin Reserve (134,710 acres) and the North Inlet/ Winyah Bay Reserve (9,000 acres), in South Carolina.

National Wildlife Refuges. Coastal refuges make up 77 million acres, or 86 percent, of the 91 million acres in the National Wildlife Refuge System administered by the U.S. Fish and Wildlife Service.

Coastal Barrier System. The Coastal Barrier Resources Act restricts federal spending and assistance for development in the Coastal Barrier Resources System. The goal is to reduce damage to these valuable and ecologically sensitive barrier islands. The system includes 560 units and 1.27 million acres.

Restoration

Along with efforts to prevent and control degradation of the coastal environment, a number of federal programs emphasize restoration of damaged and depleted resources. For example, the Coastal Wetlands Planning, Protection, and Restoration Act of 1990 (CWPPRA) provides grants to coastal states or territories for acquisition of coastal lands or waters and for restoration, enhancement, or management of coastal wetlands ecosystems. States are required to maintain acquired coastal lands or waters, providing long-term protection of the property itself, its water quality, and its dependent fish and wildlife. FWS coordinates the process through which states and other applicants submit annual proposals for CWPPRA grant

Coastal America

In 1991 the federal government established an interagency partnership to restore, preserve, and protect the living coastal heritage of the United States. The President's Council on Environmental Quality (CEQ) coordinates the partnership, whose members include agencies with stewardship responsibilities for coastal resources. In 1992 the Environmental Protection Agency (EPA) and the departments of the Interior, Army, and Commerce were joined by the departments of Agriculture, Air Force, Housing and Urban Development, Navy, and Transportation.

Coastal America partners focus federal and nonfederal legislative authorities and funding on action-oriented projects that address habitat loss, contaminated sediments, and nonpoint-source pollution.

In 1992 Coastal America sponsored projects at the local, regional, and national levels:

- **Local.** Partners initiated shovel-in-the-ground projects in each of the seven Coastal America regions, with participation by at least three federal agencies, a state/local government agency, and a nongovernmental organization. A monitoring component assesses success or failure of each effort, and an education/outreach component involves the public. Projects underway are removing obstructions to fish migrations, constructing wetlands, reducing agricultural nonpoint-source pollution from fertilizers, and stabilizing eroding shorelines.
- **Regional.** Implementation teams have a list of priority projects for which they are seeking partnerships. The New England region developed a strategy to restore coastal embayments cut off from tidal flow by transportation facilities, and Coastal America signed a resolution with the State of Connecticut to help restore its coastal salt marshes.
- **National.** The partnership has issued *Coastal Wetlands of the Continental United States: The Fragile Fringe* and a coastal video catalog. In preparation are a Reporters Guide to Ocean and Coastal Issues and a Coastal Reference and Retrieval System to provide a single coastal information system or clearinghouse for education/information materials in CD-ROM format.

funding. To date, under the program, states have acquired, protected, or restored 69,500 acres of coastal wetlands.

NOAA protects and restores habitats of living marine resources as part of its trustee responsibilities under various laws. The National Marine Fisheries Service administers the NOAA Restoration Center, which develops and directs national expertise in identifying and evaluating restoration alternatives, restoring injured trust resources, and research and development in the area of restoration methodologies.

Science and Research

While NOAA conducts most federal science programs on the coastal ocean, other agencies, particularly within the Department of the Interior, contribute as well. Half of the research conducted by the Fish and Wildlife Service concerns coastal areas and species. The Minerals Management Service and

the U.S. Geological Survey conduct coastal-related research as well.

Coastal Ocean Program. The NOAA Coastal Ocean Program focuses scientific expertise on coastal ocean and Great Lakes issues. The program seeks to improve understanding and predictive capabilities regarding coastal ocean pollution and habitat degradation, fisheries productivity, and protection of life and property in coastal areas.

North Pacific Marine Science Organization. A Convention for the North Pacific Marine Science Organization (PICES) entered into force in March 1992. Canada, Japan, and the United States are inaugural members, with China and Russia expected to become members soon. PICES has a broad mandate to promote and coordinate marine and related research, with an emphasis on the ocean's interactions with land and atmosphere; its role in global weather and climate change; flora, fauna, and ecosystems; uses and resources; and the impacts of human activity.

EPA Office of Research and Development. This office devotes its efforts to understanding the cumulative impacts of multiple stresses on marine and estuarine environments. Such efforts enable EPA water programs to move beyond their traditional chemical and effluent focus to address ecological exposure and biological responses. New EPA initiatives on habitat and biodiversity have implications for the marine environment.

Minerals Management Service Environmental Studies. Through an Environmental Studies Program, MMS conducts research on fundamental physical, chemical, and biological processes; ecosystem function; and abundance and distribution of living marine resources. The agency applies this information to decisions on management of offshore oil, gas, and mineral resources.

Interagency Collaboration. Within the President's Office of Science and Technology Policy (OSTP), the federal interagency Committee on Earth and Environmental Sciences (CEES) has a Subcommittee on U.S. Coastal Ocean Science (SUSCOS). The subcommittee coordinates the work of several agencies to obtain a predictive understanding of the processes associated with the coastal environment. Members represent the departments of the Interior, Agriculture, Commerce, Defense, Energy, State, and Transportation along with CEQ, EPA, NASA, and the National Science Foundation. The subcommittee provides long-range, coordinated planning for the federal coastal ocean science effort.

Monitoring and Assessment. The NOAA Strategic Assessment Program organizes and synthesizes existing information on U.S. coastal and ocean characteristics. NOAA also is responsible for the Large Marine Ecosystem (LME) Initiative that is developing strategies for monitoring the health of coastal ocean ecosystems around the world.

At the watershed level, the EPA National Estuary Program (NEP) develops guidance for use by individual estuary programs in monitoring the effectiveness of estuary management. The report, *Managing Troubled Waters*, issued by the National Research Council, guides development of monitoring plans for the 21 NEP estuaries and provides a model for other programs.

Department of Defense

Also see Federal Facilities Management, Pollution Prevention, and related tables and figures in Part II.

National security depends on the wellbeing of the environment, and federal agencies charged with protecting national security are also responsible for protecting the environment. The linkage between these responsibilities is evident in the environmental program of the Department of Defense (DOD). In 1991, for the first time, the United States recognized environmental issues as a national security concern. The National Security Strategy, stated:

> Global environmental concerns include such diverse but interrelated issues as stratospheric ozone depletion, climate change, food security, water supply, deforestation, biodiversity, and treatment of wastes. A common ingredient in each is that they respect no international boundaries. The stress from these environmental challenges is already contributing to political conflict. Recognizing a shared responsibility for global stewardship is a necessary step for global progress. Our partners will find the United States a ready and active participant in this effort.

DOD is steward of 25 million acres of public land at 600 major installations in the United States and of an additional 2 million acres abroad. Military installations range from a few acres for weather stations and radar sites to a million acres for training installations and bombing ranges. In spite of intensive military use for many years, DOD lands contain a rich diversity of flora and fauna.

While accomplishing its primary mission—defending the national security interests of the United States—DOD seeks to be a leader in federal agency compliance with environmental laws and regulations and stewardship of natural resources on military installations.

Conditions and Trends

In 1992 the Secretary of Defense set the pace for improving environmen-

tal quality in all DOD activities by providing that the department should:

> Fund environmental compliance, restoration and pollution prevention sufficient to achieve sustainable compliance with federal and state environmental laws and governing standards overseas; and to minimize negative mission impacts and future costs and to provide federal leadership in environmental protection.

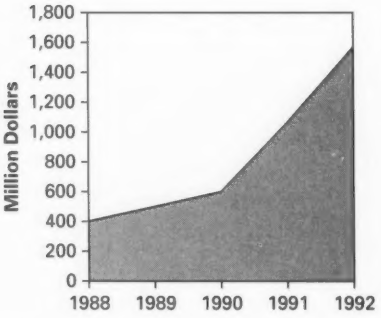
Compliance. To conduct environmental programs and to accelerate compliance and cleanups of past contamination, DOD requested and received a supplemental appropriation of $1.1 billion which brought total fiscal 1992 environmental funding to $4.2 billion.

Restoration. In fiscal 1991 DOD invested $1 billion in cleanup efforts through the Defense Environmental Restoration Program (DERP), an increase of $464 million over the previous year. Of the 1,800 military installations in DERP, only 94 have been listed on or proposed for the National Priorities List (NPL) by EPA. In 1991 EPA added one military installation to the NPL, the Pearl Harbor Naval Complex on the island of Oahu, Hawaii. DOD has completed preliminary assessments for DOD sites on the NPL and is moving from the remedial investigation and feasibility study phase into remediation and cleanup. In 1991 the Defense Environmental Restoration Program recorded the following accomplishments:

- Cleanup at a third of the 1,800 DERP sites with no further restoration actions required;
- Environmental training for 2,000 military and civilian personnel;
- A 63-percent increase in DERP sites with completed studies quantifying the amount and extent of contamination and a 26-percent increase in sites with remedial action completed.

Pollution Prevention. In addition to cleaning up sites contaminated in the past, DOD has adopted a pollution prevention strategy, in which the reduction of hazardous wastes generated by military installations figures prominently. In June 1987 DOD established the goal of reducing hazardous waste disposal by 50 percent before the end of 1992. By 1991 DOD had reduced hazardous waste disposal by 53.9 percent—a year ahead of schedule—and much of the reduction occurred during a time of increased production and maintenance activity related to Desert Shield and Desert Storm. More than 85 percent of the reduction was attributable to improvements in waste minimization efforts at DOD shipyards, maintenance depots, and air logistics centers. Such facilities account for 60 percent of all

Funding for the Defense Environmental Restoration Program (DERP).



Note: Through DERP, the Department of Defense is accelerating the cleanup of 1,800 contaminated military sites, including 90 on the National Priorities List.

Source: U.S. Department of Defense, Washington, DC, 1992.

DOD Environmental Trends

The Department of Defense is restructuring its environmental program to accelerate development of new technologies and to institute long-range planning. A recent review of environmental management led DOD to institute the following changes:

- Organizational structure, with particular emphasis on unmet needs at the regional, state, and local level;
- Education and training across all military services and members of the DOD community;
- Improvements in management of the restoration program to provide environmental protection at lower cost;
- An environmental research and development (R&D) strategic plan to focus efforts and accelerate payback from DOD environmental technology assets; and
- Systems to correct deficiencies in environmental information management.

Examples of initiatives to improve environmental management include the following:

Research and Development. DOD is working with the private sector and other government agencies on environmental research. In 1992 DOD established the Strategic Research and Development Program (SERDP) to address environmental matters of concern to DOD and the Department of Energy (DOE). The program identifies priorities in environmental research, technology, and information developed by the two departments for defense purposes. SERDP will update the DOD 5-year strategic environmental R&D plan and will provide government agencies and the private sector access to DOD environmental data. It also will identify energy technologies developed for national defense purposes that have environmentally sound, energy efficient applications for other DOD programs, for DOE and other government programs, and for industrial and commercial applications.

Long-Range Planning. In anticipation of future environmental requirements, DOD is undertaking long-range planning. In 1992 the department issued a Report on Environmental Requirements and Priorities, which examines prospects for environmental activities through the 1990s. The Department's first environmental R&D strategic plan will provide input to the environmental restoration strategic plan.

hazardous waste generated by the department. The remaining 40 percent is generated by such areas as daily installation operations and training facilities.

Policies and Programs

The DOD environmental program has four components: compliance, restoration, pollution prevention, and natural and cultural resource conservation.

Environmental Compliance

A primary element of the DOD compliance strategy is implementation of the National Environmental Policy Act (NEPA). A vehicle for minimizing environmental effects of federal actions, NEPA provides DOD decisionmakers with choices on the manner in which the military mission is to be accomplished. To address actions that may affect the environment, each of the military services has promulgated NEPA regulations.

DOD environmental compliance projects are designed to meet regulatory standards that protect human health and the environment. Projects address the following areas:

- Hazardous waste management,
- Underground storage tanks,
- Solid waste management,
- Air pollution abatement,
- Water quality management and safe drinking water, and
- Requirements based on specific environmental statutes.

To achieve compliance in these areas, the department is emphasizing education and training, an environmental ethic for the defense community, and public awareness and participation in DOD environmental activities. Each of the military departments has implemented a comprehensive environmental audit program to highlight problems at facilities before they become violations. Environmental audits enable installations to plan and budget for environmental projects needed to maintain compliance.

Pollution Prevention

Recognizing pollution prevention through source reduction as the key to a cleaner environment, DOD has adopted a pollution prevention strategy. Com-

Department of Defense hazardous waste reductions.

Year	All of DOD		DOD industrial operations	
	Waste disposal	Reduction	Waste disposal	Reduction
	thousand pounds	*%*	*thousand pounds*	*%*
1987	346.770.2	Base year	251,830.2	Base year
1988	236,573.9	-31.8	158,806.1	-36.9
1989	201,555.2	-41.9	142,062.9	-43.6
1990	207,663.3 *	-40.1	145,102.9 *	-42.2
1991	159,698.8	-53.9	91,800.8	-63.5

*Increase was related to Operation Desert Shield/Desert Storm activities.

Source: U.S. Department of Defense, Washington, DC, 1992.

ponents of the strategy, accompanied by examples, follow:

Systems Acquisition. The Navy is conducting Logistics Review Group audits of hazardous material use and hazardous material control plans for all new weapon systems and for major system modifications to ensure reduction of hazardous material and hazardous waste. The Air Force has prohibited use of certain hazardous materials, including chlorofluorocarbons, cadmium, and chromium, in the design, manufacture, and operation of the new F-22 fighter plane with no sacrifice of cost, schedule, or performance.

Material Substitution. Kelly Air Force Base, Texas, replaced cyanide stripping baths with non-cyanide strippers, thus saving $390,000 annually on treatment and disposal costs. Scranton Army Ammunition Plant, Pennsylvania, eliminated the use of chromic acid rinse in preparing steel surfaces for painting.

Process Improvement. By substituting an alternative cleaning process for vapor degreasers, the Naval Aviation Depot at Jacksonville, Florida, eliminated 300,000 pounds of hazardous waste annually and reduced volatile organic compounds emissions by 66 percent. The Naval Air Station at Mirimar, California, designed and built a totally enclosed system for recycling more than 20,000 pounds of solvent, grease, and hydraulic fluid-contaminated rags. The Navy estimates savings of $350,000 a year by using this recycling system.

Improved Material Management. The Naval Air Station at Point Mugu, California, developed a centralized hazardous material inventory control system. In the first year, purchases of hazardous materials decreased 49 percent, and hazardous waste disposal decreased 73 percent.

Alternative Energy Sources. To reduce air pollution from vehicles, DOD and DOE purchased 2,000 alternate fuel vehicles that run on electric batteries, 100-percent compressed natural gas, or 85-percent methanol/15-percent gasoline. For more information, see the Federal Facilities Management section.

The DOD Pollution Prevention Strategy is reducing pollution, improving worker protection, providing more efficient use of natural resources, and saving money. For these reasons, DOD is shifting management emphasis to pollution prevention as a low-cost, environmentally sound alternative to traditional pollution control strategies and contamination cleanup. A sampling of other DOD efforts follows.

- **Pollution Prevention Awards.** DOD installations were recipients of several of the EPA Administrator's Pollution Prevention Awards for 1991:
- **Single-Coat Paint.** The Navy Exploratory Development Program, Warminster, Pennsylvania, won for developing a new single-coat paint that reduces volatile organic compounds and hazardous waste by 67 percent.
- **Planning and Implementation.** Fairchild Air Force Base, Washington, won as a model for comprehensive pollution prevention planning and implementation.
- **R&D Pool.** The Army Depot Systems Command, Chambersburg, Pennsylvania, was a runner-up for a program that pools pollution prevention R&D among several depots.
- **Ozone-Depleting Substances.** In February 1992 President Bush announced that the United States would accelerate the phaseout of the

DOD and NEPA

Recent fundamental changes in threats to national security have prompted a major restructuring of the Department of Defense. The easing of international tensions has precipitated base closures in the United States and abroad. In 1992 proposed base closures predominated as the major actions requiring the Department of Defense (DOD) to prepare environmental impact statements (EISs) as called for by the National Environmental Policy Act (NEPA).

Base Closures. DOD worked closely with community reuse committees to develop alternatives for the reuse of closed bases and to ensure that the public was an integral part of the decisionmaking process. Base closures can have the following environmental implications:

- **Consolidation and Restationing.** The military is consolidating more activities on fewer installations with potentially greater pressure on environmental resources. Restationing and consolidation has the potential to affect regional environmental quality.
- **Sale and Reuse of Closed Facilities.** The nation has choices to make regarding the use of closed military installations.
- **Cleanups.** Base closures may affect cleanup priorities for DOD and the federal government.

Other NEPA Actions. Other actions taken by the military services in compliance with NEPA include the following examples:

- **Navy/Marines.** The Navy integrated NEPA training into the official Navy Training Plan and required it for all personnel. A Supplemental EIS for new dredging operations at two naval installations in San Francisco Bay is the result of several years of research and cooperation among the Navy, the Army Corps of Engineers, EPA, and state regulatory agencies. It will determine the most environmentally sound manner to dispose of dredge material while maintaining adequate depth for ship transit. This EIS is the major database in the designation process of a regional disposal site for dredging in San Francisco Bay. The Marine Corps, to ensure inter- disciplinary participation in NEPA decision-making, established environmental impact review boards at headquarters and at each installation. The boards review EISs and forward recommendations to decisionmakers.
- **Army.** The NEPA Compliance Manual for Base Realignment and Closure, prepared by the Army, guides preparers of NEPA analyses. It also helps ensure that military and civilian decisionmakers have adequate environmental information upon which to make decisions about the Army base structure of the twenty-first century. A 1987 environmental assessment (EA) of plans for testing the Strategic Defense Initiative on Kwajalein Atoll revealed existing environmental problems on the island and potential cumulative impacts, if the project proceeded as planned. The Army prepared an EIS to address cumulative environmental effects and detail an

extensive mitigation plan to reduce effects of the SDI proposal and mitigate environmental effects of ongoing operations.

• **Army and Air Force.** To provide information for decisionmakers, the Army and Air Force integrated the NEPA process with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) process in a unified analysis and documentation. The Air Force integrated its environmental impact analysis process under NEPA and the CERCLA process into a single effort for the BOMARC Missile accident site cleanup. The integration increased public input in developing a method and level of cleanup for the site and enhanced information available to the decisionmaker so that the best alternative could be selected.

• **Air Force.** To involve the public in the NEPA process, the Air Force recently declassified aspects of the Space Nuclear Thermal Propulsion Program. The Air Force is using the NEPA process as a forum to address public concerns about the development and testing of a new nuclear program. In 1992 the Air Force held public scoping meetings in Alaska and prepared an EIS on the environmental effects of a High Frequency Active Auroral Research Program that would build and operate an Ionosphere Research Instrument to study the basic properties of the Arctic ionosphere.

production of ozone-depleting substances by 1995. DOD developed a program to help achieve the President's goal through initiatives such as the following:

• **Army.** To reduce reliance on chlorofluorocarbons (CFCs) and halons, the Army is developing programs to apply current-technology chemicals and processes to weapon systems applications.

• **Navy.** To focus on use reduction through alternative non-CFC technologies, chemical conservation, and inventory management, the Navy is supporting research on substitute materials in two industry/government consortia—Halon Alternatives Research Corporation and the Solvents Working Group.

• **Air Force.** In addition to use reduction, the Air Force is working with industry to find or develop CFC replacements, with emphasis on alternatives to substance CFC-113 and methyl chloroform.

Environmental Restoration

In 1992 DOD accelerated characterizations of remaining contaminated sites and developed cost-reduction initiatives in an effort to produce a comprehensive restoration strategic plan to be completed by 1995. The department conducted 180 remedial actions at military installations on the National Priorities List, which included the following:

- Immediate response actions to protect public health;
- Immediate removal of contaminants;
- Alternative drinking water supplies, and
- Installation of permanent remedies such as groundwater- treatment facilities.

To date, 40 states and territories have entered into memoranda of agreement with DOD to support environmental restoration at over 400 military installations. Through cooperative agreements, DOD has reimbursed states more than $16 million for services to

expedite the review and approval of studies and cleanup decisions.

Natural and Cultural Resources

DOD sponsors the Legacy Resource Management Program to integrate biological, cultural, and geophysical resources with the demands of the military mission. The program emphasizes the stewardship of DOD lands and gives priority to identifying, conserving, and restoring natural and cultural resources. To demonstrate more effective conservation techniques, the program evaluates natural and cultural resources for their significance to such values as biodiversity and historic interpretation. DOD works through partnerships with federal, state, and local agencies and private groups.

In 1992 DOD received 1,000 Legacy proposals from the military services and another 100 proposals from private groups or other agencies. The department added 300 new Legacy demonstration projects for a total of 400 conservation projects throughout the United States and U.S. territories. Examples of Legacy natural resource-projects follow.

Management Data. The Army has developed an Integrated Training Area Management Program (ITAM) to help military trainers manage natural resources. ITAM generates data on soil types, vegetative cover, and equipment size and weight useful in management decisions regarding the rest and rotation of training lands. Implemented on 53 Army and Marine Corps installations in the United States and abroad, ITAM assists planners of base realignment and closures determine the capability of land to sustain reuse proposals.

Revitalizing Wetlands. In another Legacy project, DOD is working with the U.S. Fish and Wildlife Service and 17 conservation groups to revitalize wetlands on military installations. For example, Vandenberg Air Force Base, California, and the Nature Conservancy developed an accord to protect 5,000 acres of wetlands, 9,000 acres of undisturbed dunes, relic stands of native bunchgrass, and the largest existing remnant of globally rare Burton Mesa chaparral. The Navy joined with the Defenders of Wildlife to establish a Watchable Wildlife area at the Sprague Neck Bar Ecological Reserve, on land held by Naval Communications in Cutler, Maine. The area, a long cobble beach reaching into Machias Bay, hosts bald eagles and migrating shorebirds and waterfowl.

Cultural Resources. Legacy projects also include restoring historic buildings and sites such as a World War II chapel at Adak, Alaska; public awareness; archeological procedures; ethnohistories and oral histories; rock art; historic preservation technology; and conservation of Cold War artifacts.

Economics

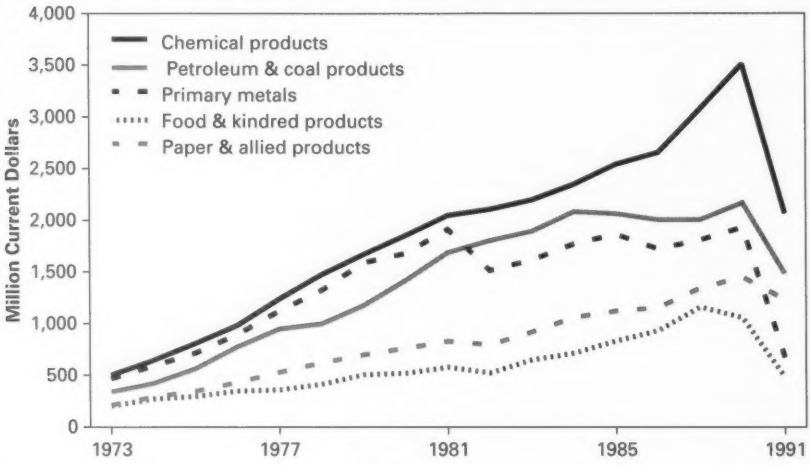
Also see Budget, Private Sector Initiatives, Pollution Prevention and related tables and figures in Part II.

During much of the last century, Americans—both producers and consumers—depleted natural resources with little thought for the environmental damage they were causing. The nation continued to overlook environmental damages until polluted water and air began to threaten human health, and native species and ecosystems began to disappear. Then, in the last 30 years, the public began to see how human activities could deplete resources and damage the environment, harming the wellbeing of present and future generations. The nation responded by enacting legislation, implementing policies, and taking private initiatives to restore and protect the environment. Americans also recognized the need to provide for a healthy economy while protecting the environment. To meet this need, policymakers in 1992 developed policies and practices to harmonize the nation's economic and environmental goals.

Conditions and Trends

Despite the environmental progress recorded during the last generation, many producers and consumers continue to make choices that unnecessarily deplete or degrade natural resources. One reason is that often the costs, particularly the environmental costs, of using natural resources are not fully paid by the users. If the costs of using natural resources do not reflect full costs, producers and consumers have little incentive to use them efficiently. For example, if polluters do not have to pay the cost of using air or water resources, then they have no incentive to limit or clean up their emissions. The federal government has begun to implement a variety of policies to ensure that economic actors recognize the full cost of using natural resources and, accordingly, better manage these resources. These policies include penalties for exceeding pollution limits and fees for the use of natural resources.

Pollution control expenditures for selected industries.



Source: See Part II, Table 11.

Shifting Emphasis

Early federal policies to protect the environment generally relied on a command-and-control approach that typically specified an environmental goal, a method to achieve that goal, a deadline, and penalties for failure to comply. While these and other approaches have produced appreciable results, pollution control costs continue to increase. Under existing and planned regulations, EPA estimates that pollution control costs will increase by nearly 50 percent between 1991 and the year 2000 (from $107 billion to $148 billion in 1986 dollars, annualized at 7 percent). Environmental policymakers must address these costs as well as more complex problems such as pollution from dispersed sources (nonpoint sources) or from hazardous waste disposal—problems that are difficult or impossible to resolve with traditional approaches.

The federal government has begun to consider and apply market-based incentives and other economic tools to help reduce the cost and improve the effectiveness of environmental protection. For example, using a market-based approach, the government specifies an environmental goal but grants polluters more flexibility in meeting that goal by using whatever methods are most cost-effective for them. Federal agencies are applying market-based incentives to a range of issues, from reducing air pollution to managing fishery resources.

New Developments

U.S. policies are constantly adjusting to both domestic and international developments. A sampling follows of developments likely to shape U.S. environmental policies in the years to come.

Budget Deficit. During the last decade, the United States was a consumer nation rather than an investor nation. Large public debts accumulated during this period, and interest payments on the national debt increased correspondingly. Because financing a growing national debt threatens to affect the U.S. standard of living, the nation is

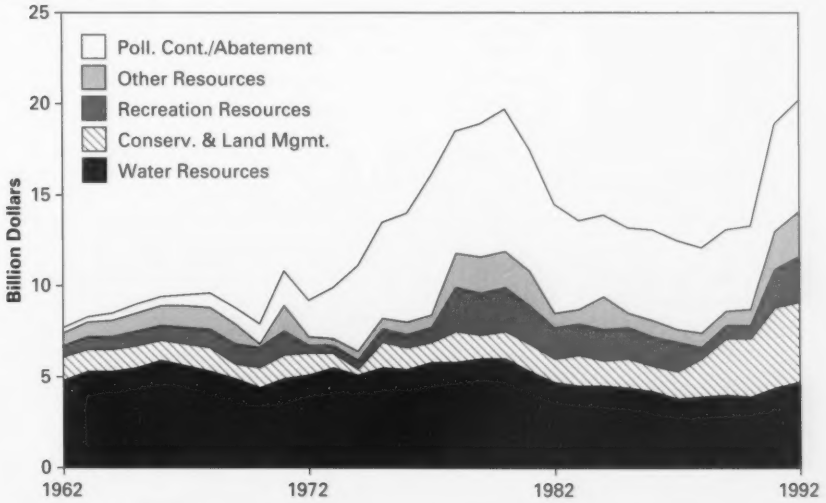
directing more attention to reducing the annual federal budget deficit. As a result, the ability of the federal government to fund new or existing environmental initiatives could be limited. In combination with public demand for a healthy environment, fiscal constraints are likely to create pressure to provide cost-effective environmental protection through innovative policy approaches.

Competitiveness. The pressure to achieve environmental goals at the lowest possible cost also extends to the private sector. As U.S. firms deal with intense competition in domestic and foreign markets, they will seek to reduce the costs of environmental regulations. Techniques such as market-based incentives, negotiated rulemakings, innovative production practices, and voluntary partnerships promise to improve the U.S. standard of living and environmental quality by reducing the cost of achieving environmental goals. In turn, the development and application of cost-effective environmental policies will assist U.S. firms and workers in remaining competitive in world markets. Firms that succeed in developing environmentally sensitive products and cost-effective solutions to environmental problems may also be able to market their products and services in the United States and around the world.

Managing Natural Resources. Every industry uses natural resources to some extent to produce goods and services. In the nation's $5.7 trillion economy, agriculture, forestry, fisheries, and mining contributed nearly $128 billion to national income in 1991. Even with the need to address the budget deficit, the conservation of natural resources is essential to U.S. economic and personal wellbeing.

Budget deficits create pressure for the federal government to increase net revenues from development of natural resources in the public domain. One possible approach to these budgetary

U.S. federal gross spending for natural resources and environment.



Source: See Part II, Table 12.

pressures would be for the federal government to consider reducing further or eliminating subsidies and establishing more appropriate fees for uses of public lands that deplete or degrade natural resources, such as mining, timber harvesting, grazing, and fishing. Under a market-based approach, resource users pay fees that better reflect depletion or damage costs. Such fees provide an incentive to use natural resources more efficiently.

Expenditures and Revenues. EPA estimates that U.S. spending for 1991 pollution abatement and control by both public and private sectors was $107 billion (annualized cost at 7 percent using 1986 constant dollars). From 1972 to 1991 pollution control costs quadrupled from $26 billion (0.9 percent of GDP) to $107 billion (2.2 percent of GDP). EPA estimates that these costs will continue to grow, reaching approximately $148 billion (2.6 percent of GDP) by the year 2000. More than 37 percent of these expenditures are for capital costs such as technology and equipment, while about 53 percent are for operating costs.

In 1992 direct gross federal expenditures for natural resources and the environment totaled an estimated $20.2 billion, with the largest portion, $6.1 billion, allocated to pollution control and prevention. Real federal expenditures (1987 constant dollars) for natural resources and the environment peaked in 1980, but these expenditures have steadily increased by a total of $3 billion from 1987 to 1991.

In 1992 the federal government collected an estimated $7.6 billion in revenues from natural resources and environment-related sources such the following:

- Royalties and fees from leasing and extraction of oil, natural gas, and minerals ($2.8 billion);
- Fees from timber harvesting, grazing, and other land product uses ($1.6 billion);
- Taxes on chlorofluorocarbons ($662 million);
- Penalties and recoveries from environmental cleanup ($2 billion).

Pressure to reduce the budget deficit and address the costs of pollution control and managing the nation's natural resources will challenge policymakers to develop innovative, cost-effective ways to address these concerns.

National Economic Accounts. Nations measure the monetary value of goods and services from economic activity as an indicator of national well-being. One of these measures is gross domestic product (GDP)—the value of goods and services produced within the borders of a nation. Currently, however, accounting systems used to estimate GDP do not reflect depletion or degradation of the natural resources used to produce goods and services. For example, the United States could increase GDP with goods and services by overharvesting the national forests, but the GDP figures would not reflect the net depletion of the nation's timber resources and associated environmental damages. As a result, an increase in GDP from economic activities that deplete or degrade natural resources is not a good indicator of a nation's ability to derive income and other benefits from natural resources in the future. Economists within government agencies and in the private sector are studying how to count depletion or degradation of natural resources in national economic accounts.

International Considerations. With the end of the Cold War, nations are devoting increased attention to shared economic and environmental

challenges. This development is essential since many environmental problems, such as acid rain, ozone depletion, and climate change can only be addressed effectively through global cooperation.

Nations have also begun to consider longer-term or sustainable approaches to economic development and environmental protection. Although sustainable development has no universally accepted definition, it may be considered as a way to provide equal or greater opportunities for future generations to enjoy economic and personal wellbeing. The United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in June 1992, adopted several landmark agreements among nations to promote sustainable development, with an emphasis on market-based strategies. For a discussion of these issues and agreements, see the International Issues section.

Programs and Policies

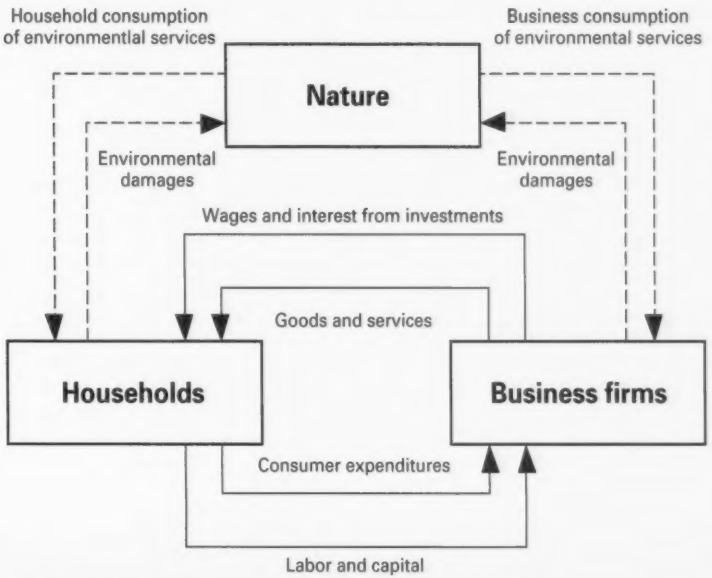
In 1992 the federal government continued its efforts to integrate economic and environmental policies. Such efforts included initiatives aimed at providing better information and incorporating market-based incentives into environmental programs.

Environmental Accounting and Valuation

Current efforts in environmental accounting and valuation include the following initiatives:

Satellite Accounts for Natural Resources. The Bureau of Economic Analysis (BEA), within the Department of Commerce, is investigating the feasi-

Environmental-economic interactions in environmental accounting.



Source: Environmental Protection Agency, Washington, DC, 1992.

Trade and the Environment

The intersection of environmental and trade concerns received unprecedented attention in 1992. Trade liberalization, generally associated with shifts in economic activities, can provide additional financial resources to countries and regions that could be used for environmental protection. At the same time, economic changes generated by open trade can have significant environmental consequences.

NAFTA. The year's landmark event in this area was the North American Free Trade Agreement (NAFTA) reached by the United States, Mexico, and Canada in October. NAFTA has become an international model for the integration of trade liberalization and environmental protection. In May 1991 the Bush administration pledged to make environmental concerns a key component of NAFTA and related negotiations. In early 1992 the U.S. trade representative published a review of NAFTA environmental issues, including recommendations for negotiators. As a result, NAFTA includes the following provisions:

- The countries agreed to explicit language affirming their commitment to promote sustainable development.
- NAFTA states that signatories should not lower health, safety, or environmental standards for the purpose of attracting investment, and it states the resolve of the countries to implement the agreement in a manner consistent with environmental protection.
- The countries will strive for congruence of various environmental standards, while affirming each country's right to choose the level of environmental protection that it considers appropriate.
- NAFTA dispute settlement panels are encouraged to call on environmental experts to provide advice on factual questions related to the environment.

On a parallel track, NAFTA countries agreed to establish a North American Commission on the Environment (NACE) comprised of the environment ministers from the three countries. NACE will provide a forum at which the countries can cooperate on issues of mutual concern, including the environmental effects of trade.

Also in 1992 the United States and Mexico initialed an agreement to establish a Joint Committee for the Protection and Improvement of the Environment. This agreement lays the foundation for cooperation in environmental training and enforcement on a country-wide basis.

Trade and the Environment, (continued)

The two countries developed and implemented a 1992-1994 Integrated Environmental Plan for the U.S.-Mexico Border Area, focusing on water quality improvement, air pollution monitoring, hazardous waste tracking, emergency response, enforcement cooperation, and pollution prevention. The U.S. Congress provided $208 million in fiscal 1993 for implementation of the plan, and the Mexican government is expected to provide $160 million.

UNCED. Trade and environment discussions fostered by UNCED reflected an international consensus that trade liberalization and stronger environmental protection can and must proceed in tandem. Principle 12 of the Rio Declaration reads:

> States should cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation. Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. Unilateral actions to deal with environmental challenges outside the jurisdiction of the importing country should be avoided . . .

OECD and the GATT. Among the leading international economic institutions are the Organization for Economic Cooperation and Development (OECD), involving 24 industrialized nations, and the General Agreement on Tariffs and Trade (GATT), which governs international trade. Among topics discussed by these fora are the use of trade restrictions for environmental purposes and the competitive effects of environmental regulation. For example, in 1991 a GATT panel ruled that the U.S. Marine Mammal Protection Act, which bans the import of tuna from nations whose fleets have an excessive rate of dolphin bycatch, violates international rules against discriminatory trade practices. Trade and environmental experts also debated the implications of proposed changes in the multilateral trading system.

Within OECD, the United States is taking a leading role in developing guiding principles for trade and environment. In doing so, the Bush administration has sought the views of nongovernmental groups concerned with trade and the environment.

bility of developing satellite accounts for natural resources that will supplement the U.S. national economic accounts. Such accounts would record the depletion of natural resources. BEA plans to initially investigate the feasibility of satellite accounts for petroleum—a nonrenewable natural resource, and timber—a renewable natural resource.

In 1993 the United Nations Statistical Commission likely will adopt new international guidelines on economic accounting. The guidelines would lay the groundwork for developing satellite accounts in each country to record the depletion of natural resources. BEA has participated in developing the U.N. guidelines and expects to move U.S. accounts closer to the international guidelines in the future.

Chesapeake Bay Accounting. EPA is exploring methods to introduce environmental considerations into conventional economic accounting systems. For example, the Chesapeake Bay may be considered as a collection of natural assets providing goods and services valued by society. Because most of these natural assets are not bought and sold in the marketplace, they have no observable market prices to record their value and depreciation over time in existing domestic income accounts. In 1992 EPA supported a study in which researchers developed an environmental accounting system of the Chesapeake Bay to incorporate the value and depletion of its natural assets into domestic income accounts. The EPA Science Advisory Board is reviewing the study, and a final report is in progress.

Coastal Environmental Valuation. To meet the needs of state and local planners and coastal zone managers, the National Oceanic and Atmospheric Association (NOAA) established an Economics Group within its Coastal Ocean Program. This group initiated a project to assist with valuation of natural resources and environmental impacts for damage assessments and resource management purposes. NOAA also assembled a panel of experts to review and comment on the use of the contingent valuation method, which surveys public opinion as a technique for estimating values of natural resources in monetary terms. The panel's review of the contingent valuation method should be available in 1993.

Harnessing Market Forces

To harness market forces to benefit the environment, federal agencies are undertaking many initiatives, including the following:

Marketing Guidelines. In July 1992 the Federal Trade Commission (FTC) issued national guidelines to prevent misleading environmental marketing claims and provide consumers with the information necessary to choose products that minimize environmental damage. Through the FTC guidelines and educational efforts on environmental claims, consumers will have access to information to make more informed choices in the marketplace. For more information on the FTC guidelines, see the Pollution Prevention section.

Regional Emissions Trading. The South Coast Air Quality Management District (SCAQMD) in California is developing a marketable permits program to establish a Regional Clean Air Incentives Market (RECLAIM). The goals are to lower costs, increase flexibility, and attain state and federal air quality standards. The district will submit the program to EPA for review and approval as part of the California State Implementation Plan required by the Clean Air Act. EPA is assisting in

Harnessing Market Forces: Tradable Permits

In 1992 the Environmental Protection Agency (EPA) sponsored initiatives that use tradable permits to improve national efficiency in attaining air and water quality goals. Under a tradable or marketable permit system, EPA issues firms permits for allowable pollutant emissions. Firms may then choose a compliance strategy that is the most appropriate and cost-effective for their operation. If a firm with relatively low compliance costs can reduce its pollutant emissions below the allowable level, it can sell or trade its extra pollution allowance to others. In short, the system achieves an overall national pollution reduction goal while creating an economic incentive for firms to reduce pollution emissions using more efficient and cost-effective approaches. The success of market-based trading will depend on the ability of polluters to efficiently reduce their emissions, engage in trading, and meet the overall environmental goal.

In contrast, the traditional command-and-control approach, which forces every firm to reduce emissions by a certain percentage or use a specific technology, imposes widely varying costs on polluters. Traditional approaches alone provide little incentive or flexibility to minimize costs and comply with requirements to achieve the environmental goal.

developing state regulations to implement the program, with special attention to emissions quantification, monitoring methods, and enforcement provisions.

Mobile-Stationary Source Trading Program. Under this program, EPA provides guidance to states to clarify how certain requirements of the Clean Air Act Amendments of 1990 can be satisfied by trading emission reductions between mobile and stationary sources of air pollution. For example, a stationary pollution source such as a refinery might be allowed to meet or offset emission reduction requirements by purchasing and scrapping old, high-polluting cars—a mobile pollution source. Removing old, polluting cars from the highways, known as "cash for clunkers," could be used as a cost-effective way for stationary sources to meet certain emission reduction requirements or generate tradeable offsets to help meet new source review requirements.

Point-Nonpoint Source Trading. In 1992 EPA continued studying the potential of trading between point and nonpoint sources of water pollution. Under most scenarios being considered, regulated point sources could defer water treatment system upgrades, if they would pay for or arrange for equivalent or greater reductions in nonpoint source pollution within the same watershed. EPA has approved some use of point-nonpoint source trading involving nutrient pollutants in water bodies that currently have water quality problems. Programs have been developed for Cherry Creek Reservoir and Dillon Reservoir in Colorado and for Tar-Palmico River Basin in North Carolina. EPA and other agencies are evaluating the results of these programs.

Market-Based Environmental Incentives

The Environmental Protection Agency (EPA) began to make use of market-based environmental incentives in 1976 and since then has added new programs that include the following:

Incentive Program	Date
Offset Program	1976
Offset Banking Program	1977
Bubble Program	1979
Netting Program	1980
Point Source Trading in Water	1981
Wetland Mitigation Banking	1981
Steel Industry Effluent Bubble in Water	1982
Lead in Gasoline Phasedown: Trading Program	1983
Point-Nonpoint Source Trading in Water	1984
Lead in Gasoline Phasedown: Banking Program	1985
Heavy Duty Truck Engine Emissions Averaging	1985
Emissions Trading Policy	1986
New-Source-Performance-Standards Compliance Bubble Policy	1987
Stack Height Emissions Averaging	1987
CFC Trading Program	1988
Extended Heavy Duty Truck Engine Emissions Averaging (Banking and Trading)	1990
Acid Rain SO2 Allowance Trading Program	1991
Acid Rain Industrial Source Opt-in Program	1991
Acid Rain NOx Averaging Program	1991
Air Toxics Early Reductions Program	1991

Conservation and Management

Environmental economics can serve natural resources management in a number of ways. Examples follow.

Damage Assessments. By requiring the polluter to pay the costs of damages to natural resources, the federal government can provide an incentive to prevent future pollution. Under the Oil Pollution Act of 1990 and the Superfund Amendments and Reauthorization Act of 1986, NOAA and the Department of the Interior (DOI) are developing regulations to measure damages resulting from releases of oil and hazardous substances into the environment. NOAA and DOI assist government agencies designated as natural resource trustees to measure the ecological effects and economic damages of such accidents. Damage assessments enable government agencies to recover damages to natural resources from liable parties, and trustees may use the monies recovered to restore injured resources.

Incremental Cost Analysis. In 1992 the U.S. Army Corps of Engineers invested $330 million in fish and wildlife restoration projects and pro-

Market-Based Environmental Incentives, (continued)

Air Toxics Offsets Program	1991
Oxygenated Fuels: Averaging and Trading	1991
Reformulated Gasoline: Averaging and Trading	1991
Clean Fuels Fleet Credit Program	1991
Clean Fuels Vehicle Credit Program (California Pilot)	1991
State and Local Incentive Programs, such as Regional Clean Air Incentives Markets (RECLAIM)	1992
Economic Incentives Rule Expansion	1992*
Mobile-Stationary Source Trading Guidance	1992*
Air Toxics MACT** Averaging, such as HON***	1992*
Scrappage of Old Cars	1992*
Point-Nonpoint Source Trading	1992*
Privatization of Wastewater Systems	1992*
Safer Pesticides Incentives	1992*
Streamlining Regulations of Premanufacture Notification	1992*
Water Conservation Partnership	1992*
Municipal Solid Waste Pricing	1992*
State Grants for Air Incentives	1992*

* New initiatives
** MACT = Maximum Available Control Technology
*** HON = Hazardous Organic NESHAP (National Emissions Standards for Hazardous Air Pollution)

grams. To assure the most efficient allocation of funds, the Corps is developing and applying incremental cost analysis and other economic-ecological based approaches to improve the environmental planning and evaluation process. Incremental cost analysis is a tool for identifying the best option for habitat protection, mitigation, or restoration based on the quality and cost of obtaining additional habitat units.

Conservation Reserve Program. In 1992 the Department of Agriculture (USDA) used economic and environmental principles to evaluate bids submitted by farmers to retire highly erodible cropland under the voluntary Conservation Reserve Program (CRP). More than half of current CRP acres are located in the Great Plains. However, since passage of the Food, Agricultural, Conservation, and Trade Act of 1990, USDA has shifted new enrollments to the midwest and eastern states through a redesigned bid acceptance process and new eligibility criteria. These changes allow USDA to emphasize water quality improvement and select acres to obtain the greatest conservation and environmental benefits per dollar. Of the 1.5

million acres enrolled in CRP in 1991, about 31 percent were located in the Great Plains and mountain regions and more than 13 percent (195,000 acres) were enrolled in Conservation Priority watersheds, including the Chesapeake Bay, Long Island Sound, and the Great Lakes. USDA also accepted more than 24,000 acres in high priority watersheds to improve water quality in coordination with the President's Water Quality Initiative.

Desert Tortoise Conservation Program. The Desert Tortoise Conservation Program of suburban Las Vegas, Nevada, is a good example of integrating environmental and economic considerations. In the 1980s conflict arose between homebuilders and conservationists over the decline of the endangered desert tortoise. After years of costly, protracted litigation, the Southern Nevada Homebuilders Association agreed to negotiate a tortoise habitat conservation plan with local governments, the Fish and Wildlife Service and Bureau of Land Management in DOI, and two private groups—the Environmental Defense Fund and The Nature Conservancy

The conservation plan calls for at least 400,000 acres of prime desert tortoise habitat to be set aside in exchange for development rights to more than 22,000 acres of private land in urban areas of Las Vegas. As a condition of federal permits allowing development, builders agreed to contribute $2.5 million to establish a Desert Tortoise Conservation Center. For every acre developed within the permit boundary, builders contribute $550 to the fund for habitat acquisition and management. The federal government has acquired 160,000 acres of land for the tortoise. This ongoing effort provides a model for incorporating economic considerations to protect endangered species and their habitats.

Education

Also see Private Sector Initiatives and related tables and figures in Part II.

Public-private partnerships are the key to success in environmental education as well as in other environmental disciplines.

Conditions and Trends

Public interest in environmental education has fluctuated over past decades, but in the 1990s it received new impetus from the America 2000 Education Strategy developed by President Bush and the state governors. The strategy aims to accomplish excellence-in-education goals by the year 2000. Three of these goals—making U.S. students first in the world in science and mathematics, spurring student citizenship, and continuing education through adulthood—are key factors in environmental education.

Another boost came with passage of the National Environmental Education Act of 1990, which targets students in elementary and secondary schools, as well as post-secondary students, senior citizens, and the general public. The law calls for collaboration between the federal government and the media, private industry, museums, libraries, parks, and recreation facilities, and it recognizes the need for international cooperation.

To coordinate these efforts, the 1990 law required EPA to establish an Office of Environmental Education (OEE), which is now in place. The office will work to ensure that U.S. environmental education efforts remain well organized and consistent, regardless of future peaks and valleys in public interest.

Policies and Programs

Achieving the America 2000 goals of excellence in education will require the cooperation of individuals in schools and colleges, federal, state and local governments, professional and public interest groups, business, and industry. In 1992 the EPA Office of Environmental Education, acting as an advocate for the mission nationally and

internationally, emphasized that environmental educators have a dual charge:

- Instill an environmental ethic in America's young people that will prepare them to deal responsibly with the environment throughout their lives, and
- Raise the environmental awareness of adults as informed consumers in the global shift toward sustainable development and pollution prevention.

In 1992 OEE set goals to help federal agencies implement America 2000. A listing of these goals and examples of current efforts to achieve them follow.

Goal 1. Expand communications with environmental experts.

A strong body of research and literature exists along with an experienced cadre of environmental educators. Federal agencies are establishing communications and advisory networks with educators to ensure that the nation has full benefit of their expertise.

National Environmental Education Advisory Council. The 1990 Environmental Education Act called for creation of an advisory council to make recommendations on implementing the act and to prepare a biennial report to Congress assessing the quality of environmental education in the nation and offering recommendations for improvement. EPA established an 11-member advisory council that represents the nation's geographic areas, minority groups, and a variety of occupations.

Federal Task Force on Environmental Education. NEEA also called for a network to coordinate environmental education efforts among federal agencies. Members of the Federal Task Force on Environmental Education include CEQ, EPA, the departments of the Interior, Agriculture, Defense, Education, Energy, State, and Health and Human Services, the Agency for International Development (USAID), National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), National Science Foundation, Peace Corps, Tennessee Valley Authority, and U.S. Information Agency. Task Force subcommittees are developing specific areas for collaboration.

EPA Environmental Education Advisory Board. This board consists of 35 senior representatives from EPA headquarters, regional offices, and research laboratories. Six subcommittees are developing programs, policies, and procedures required by the 1990 act.

Pollution Prevention Advisory Group. This external advisory group makes recommendations to EPA on developing pollution prevention educational materials for students and on teacher training. The 20 members have expertise in education, publishing, communications, minority concerns, and the environment.

NEPA Education and Training Courses. The National Environmental Policy Act of 1969 (NEPA) established a national policy to promote environmental quality, as well as procedures to help federal agencies focus on that goal. Dozens of federal agencies as well as private entities and universities conduct training and educational courses on the NEPA environmental impact statement process, its requirements, and how it can be better used to integrate environmental values into the federal decision-making process to reduce conflict, litigation, and cost. CEQ has compiled

a compendium that lists and describes NEPA training courses; copies can be obtained from the Council on Environmental Quality, Executive Office of the President.

Goal 2. Develop Partnerships to Increase Effectiveness and to Maximize Use of Limited Resources

Federal agencies are forming new coalitions and cooperative ventures with groups not traditionally involved in environmental education, such as industry, religious organizations, and senior citizen associations. By engaging all stakeholders in the process and by developing partnerships with grassroots organizations, federal agencies can ensure that programs are responsive to local needs.

Goal 3. Increase the number and skills of teachers who infuse environmental issues into their curricula.

Federal agencies are supporting the development of training programs and materials to ensure that all teachers, including those in nonscientific fields, have the opportunity to receive training and materials that will allow the infusion of environmental education into their curricula.

Teacher-Training Grants. In 1992 EPA awarded a $1.6 million grant to a consortium of academic institutions, corporations, and nonprofit organizations headed by the University of Michigan to develop and operate a national environmental education and training program. The program targets in-service teachers (K-12) as well as other educators and includes curriculum development and evaluation, teacher training, and information dissemination.

Wetlands Education. The Fish and Wildlife Service, in cooperation with the U.S. Geological Survey, has produced an educational poster for elementary and middle school teachers. Entitled, "Wetlands: Water, Wildlife, Plants and People," the poster features color aerial views of various types of wetlands and on the back has lesson plans and classroom activities. FWS has distributed 200,000 copies to staff, other federal agencies, private organizations, and educators throughout the United States. Sciencescope and Science for Children, publications which circulate to 90,000 teachers, featured the poster as a special pullout in their September 1992 issues. Copies are available from USGS.

Pollution Prevention. The EPA Pollution Prevention Task Force, an external advisory group, is developing a teacher-training plan and educational materials. With guidance from the task force and input from teachers and environmentalists, EPA has designed materials for grades K-12. The project complements the national program being developed by the University of Michigan consortium and may be incorporated into it.

Parks as Classrooms. Through this initiative, the National Park Service enters into partnerships with local schools to develop curricula and provide educational services for students who visit parks on field trips. In 1992 NPS supported 41 projects with funding of $780,000. Training courses emphasizing cultural, heritage, and environmental themes prepare interpreters to develop NPS educational programs. Other projects include curriculum development and an exchange-education project developed by the Everglades National Park involving two schools, one in Miami and the other in Chicago.

Federal Partnerships in Environmental Education

Federal agencies are forming partnerships with an array of public and private organizations.

Youth Partnerships

A number of public-private partnerships, such as the following, are dedicated to educating the nation's youth on environmental issues.

Students Watching Over Our Planet Earth. SWOOPE is offered on the East Coast through a partnership between EPA and the Department of Energy. It teaches students in grades K-12 environmental science through hands-on experience.

Boy Scouts and Girl Scouts. EPA has signed memoranda of understanding (MOU) with the Boy Scouts and the Girl Scouts to reinforce environmental education.

Trail Boss. EPA, the departments of the Interior, Agriculture, and Defense, and the Boy Scouts of America developed this program to teach skills for training and leading volunteer crews involved in conservation projects.

Future Farmers of America. EPA and FFA have signed an MOU to coordinate environmental education materials and activities. FFA, which includes environmental issues in its primary mission of agricultural education, will collaborate with EPA on new approaches and materials for environmental education. EPA is developing a similar MOU with the National 4-H Council.

Partnerships with Environmental Groups

Federal agencies are working with a number of environmental groups on initiatives, such as the following:

North American Association for Environmental Education. EPA and NAAEE have signed an MOU to coordinate conferences, grant and internship programs, research, and meetings of the National Environmental Education Advisory Council.

Alliance for Environmental Education. AEE, a coalition of organizations, agencies, corporations, and institutions committed to public environmental education is working with EPA and Time/Warner on a mass media campaign to broadcast environmental messages to households nationwide.

National Environmental Education and Training Foundation (NEET). CEQ oversees participation by federal agencies in this nonprofit educational foundation. The EPA Office of Environmental Education, assisted by NEET, is working on plans for partnerships with businesses.

Toronto Global Conference on Environmental Education. This conference, held at Toronto, Canada, on October 16, 1992, was a follow-up to actions taken on global environmental education at the U.N. Conference on Environment and Development (UNCED) held in June 1992.

National Audubon Society. The Audubon Society, Dow Chemical, and EPA collaborated on a pilot environmental education program for seventh graders in the Great Lakes Region.

Partners Outdoors Action Group for Environmental Education. The Department of the Interior organized this group, whose members represent federal agencies such as Fish and Wildlife Service, EPA, TVA, and

USDA Forest Service; environmental organizations, such as NAAEE and the Wildlife Habitat Enhancement Council; and businesses such as L.L. Bean and Times Mirror Magazines, Inc. The mission is to incorporate environmental education in outdoor recreational facilities and products.

Academy for Educational Development. The Fish and Wildlife Service (FWS) is working with AED and NAAEE to develop social marketing and educational methods to resolve human caused environmental problems on wildlife refuges.

Partnerships with Business

A videotape called "A Home for Pearl" teaches elementary students about wildlife habitat. The video was produced by the U.S. Fish and Wildlife Service, with a $25,000 grant from the Phillips Petroleum Company to the National Fish and Wildlife Foundation to distribute the video and teacher's guide to U.S. teachers. The Southern Educational Communications Association (SECA) transmitted the video by satellite to public TV stations in 47 states and distributed 20,000 teacher's guides. The U.S. Information Agency transmitted the video by satellite to U.S. embassies all over the world. Viewers have requested copies in French, Spanish, and Russian, and the video is being shown in Indonesia, the Bahamas, India, Namibia, and Madagascar. With its partners, FWS has distributed 7,500 copies of the videotape.

EPA collaborates with private corporations on pilot educational projects, educational materials, and environmental awards.

Partnerships with Health Organizations

Public-private partnerships are increasing educational efforts to reduce health problems associated with environmental factors, such as lead poisoning. The EPA Office of Environmental Education is concentrating on educational programs in urban areas to target segments of the population that are not being reached, such as minority and multiethnic communities, senior citizens, and illiterate persons.

Partnerships with State and Local Governments

Many state and local governments have environmental education programs in place that can serve as models for other locales. OEE is collaborating with public agencies at all levels to disperse information, reinforce consistent messages, and minimize duplication of effort.

Partnerships with Academia

Liaisons with colleges and universities inform federal agencies on current research and innovative educational methods. OEE is using grant programs to fund environmental initiatives at institutions of higher education.

Partnerships with Senior Citizen Groups

Many senior citizens have the time to take part in environmental education programs of benefit to their communities. OEE is contacting senior citizens organizations, especially retired educators, to enlist their support in carrying out environmental education projects that reach all segments of society.

D. W. Harp, The Chesapeake Bay Foundation.

Environmental education programs instill an environmental ethic in children and adults.

Heritage Program. The Bureau of Land Management (BLM) has designed a program to strengthen school children's sense of personal stewardship of America's cultural heritage. In 1992 BLM launched the program with an educational video, featuring the Teenage Mutant Ninja Turtles. Two articles on the program appeared in Science and Children, a professional magazine for science teachers, and BLM took part in seven partnership projects to publicize the program.

Goal 4. Encourage and support grassroots efforts.

Because innovative grassroots projects can be particularly responsive to local needs, federal agencies support environmental education efforts at the local level. In 1992 OEE awarded $2.4 million in grants to schools, states, and nonprofit organizations to support environmental education projects around the country. Individual grants were as high as $250,000, but the majority were $5,000 or less. Some projects focus on specific issues such as water, air, and solid waste management, while others emphasize general environmental education either locally or globally. Educational approaches range from community cleanup to computer games. EPA selects projects for their innovation and applicability in other communities, soliciting grant applications in the fall of each year by means of notices in the Federal Register.

Goal 5. Promote careers in the environmental field.

As the public becomes more aware of global environmental problems, federal agencies are increasing called on to support environmental research. The nation needs environmental scientists, engineers, and other professionals capable of developing preventive solutions

Environmental Education Grants

The following are examples of over 100 environmental education grants awarded by EPA in 1992 under the National Environmental Education Act:

- **Millions of Trees.** The Napa Valley Unified School District in California received a $16,835 grant to fund this project, in which students raise living Christmas trees and a variety of native plants that are later used to reforest local areas.
- **If Everyone Lived Like Me.** The Elachee Nature Science Center and Creative Museum in Georgia received an $87,500 grant to create an interactive video software program for school children and adults to educate consumers to reduce global pollution.
- **Waste Not, Want Not.** The Colo-Nesco Community School in Iowa received a $5,000 grant to help equip students to assess environmental issues and to foster international cooperation by addressing such issues.
- **Seed-to-Table Farm Stewardship Exhibit.** Maine Organic Farmers & Gardeners Association received a $5,000 grant to prepare a walk-through exhibit for display at public events in New England. Models, games, stories, photos, and performers demonstrate farming practices to protect natural ecosystems.
- **Building a Wetlands.** The Howard County Public School System in Maryland received a $22,440 grant to create a wetlands using recycled materials and to develop study areas and curricula for school and community use.

to environmental problems. EPA promotes environmental careers and encourages participation of minority students in environmental degree programs through a number of programs, such as the following:

Internships and Fellowship. EPA administers programs that place college interns and in-service teachers in federal agencies active in environmental education. Internships encourage college students to pursue careers in environmental science, and fellowships encourage teachers to take their environmental experience back into the classrooms, thereby educating students about the environment and promoting the pursuit of environmental careers.

NOAA administers the Dean John A. Knauss Marine Policy Fellowship that annually supports up to 25 graduate students in the Sea Grant College Program Network for one year of educational experience in Washington, D.C. Federal agencies or Congressional staffs host the fellows, who work on assignments related to the marine environment.

President's Environmental Youth Awards. Young people in all 50 states compete annually in this program which honors outstanding commitment to the environment. National award winners, selected by EPA regional offices, participate in a recognition program in Washington, D.C. Since 1989 President

President's Environmental Youth Awards Recipients, 1992.

Recipient	Location	Project
Lafayette Regional School	Franconia, NH	GreenKids: environmental education and activism.
Solomon Schecter Day School	Commack, NY	Project C.R.E.A.T.E. (Children Recycling, Acting to save the Environment): environmental education and activism.
Aaron Cohen	Upper Darby, PA	Recycling Awareness Week: recycling and reuse.
Blue Ridge Elementary School	Evans, GA	Conservation Through Education—The 3 Rs (Recycling, Restoring the Environment, and Regenerating a Love and Appreciation of the Earth: environmental activism.
Rachael Hastings	Rochester Hills, MI	Science project: monitoring and improving local water quality.
Becker Elementary School	Austin, TX	The Green Classroom: pollution prevention and education.
Elisabeth Reba Clubine	Carthage, MO	Water quality project: conservation, aquatic science, and stream cleanup.
Hygiene Elementary School	Hygiene, CO	Tropical Discoveries: environmental education and conservation.
Memorial Academy	San Diego, CA	Energy Club: environmental education, recycling, and energy efficiency.
Willow Elementary School	Willow, AK	The Kid Log Company: recycling and conservation.

Source: U.S. Environmental Protection Agency, 1992.

Bush has hosted ceremonies at the White House to honor the ten annual award winners.

National Environmental Education Awards. A new federal awards program creates the following awards to recognize individuals for their contributions to environmental education:

- **Theodore Roosevelt Award** for an outstanding career in environmental education, teaching, or administration;
- **Henry David Thoreau Award** for outstanding literature on the natural environment and pollution problems;
- **Rachel Carson Award** for an exceptional print, film, or broadcast contribution to public education on environmental issues; and
- **Gifford Pinchot Award** for an outstanding educational contribution to forestry and natural resource management.

President's Environment and Conservation Challenge Awards. CEQ, working with private-sector partners, manages this program to recognize U.S. citizens and organizations for outstanding contributions to the nation's environmental quality. One of the four award categories is Education and Communications, in which Presidential medals are awarded for developing informational programs that inspire respect for the environment and raise the public's environmental awareness. For more information, see the Private Sector Initiatives section.

National Network for Environmental Management Studies. NNEMS provides fellowships or paid internships to students in exchange for written studies or reports on environmental science, policy, and management in areas of concern to EPA. Most recipients are students conducting master or doctoral research.

Goal 6. Provide educators and the public with access to appropriate environmental education materials.

A quantity of environmental education materials exists, but quality varies and finding appropriate materials can be difficult. To categorize and provide access to the best materials available, federal agencies have the following efforts underway:

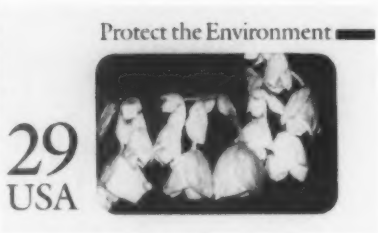
Clearinghouse. To facilitate information exchange, EPA is developing an interactive computer system for environmental education materials produced by federal agencies and other organizations. EPA is testing the clearinghouse, designed for educators (K-12), during the 1992-1993 school year and plans to have it available to the public for the 1993-1994 school year.

Earth Notes. This quarterly periodical, published by the EPA Office of Environmental Education, contains innovative ideas from educators (K-6) about their first-hand experiences in bringing environmental education into the classroom. The periodical provides an open forum for the exchange of teaching ideas, comments, and brief essays concerning environmental education in the elementary grades.

***Wee Deliver* Newsletter.** The U.S. Postal Service publishes this newsletter read by 1 million school children. The Postal Service and EPA developed a multi-page environmental insert on recycling and pollution prevention for the March 1992 issue, which was distributed to 7,000 elementary schools nationwide.

Goal 7. Educate the general public to make informed decisions.

U.S. Postal Service.



The U.S. Postal Service issued this environmental stamp on Earth Day, April 22, 1992.

Federal agencies are improving their ability to communicate complex scientific and technical information to the public. To prepare citizens to make informed decisions on the environment, federal agencies are sponsoring projects such as the following;

Media Strategy. EPA is developing a media strategy that federal agencies can use to reach the general public with information about actions that individuals can take to make a difference in the environment. The strategy enlists the help of private partners and the media, including press, television, and radio.

Marine Environmental Outreach. In 1992 the U.S. Coast Guard developed an outreach program for the general public and the marine industry. The campaign, scheduled for implementation in early 1993, will raise awareness of regional, national, and international marine pollution issues impacting U.S. waters. To improve relations with private groups, the Coast Guard will publish a Marine Environment Protection Strategy and a newsletter with updates on such topics as plastics in the marine environment, spill-reporting mechanisms, and the unintentional introduction of nonindigenous aquatic species into U.S. waters by ship ballast discharges.

Sea Grant Marine Advisory Service. The NOAA Sea Grant Network sponsors public education/outreach programs that utilize a network of extension professionals in every coastal state. The programs target teachers, state and local policymakers, industrial leaders, and the general public. Educational efforts promote appropriate strategies to protect and wisely use aquatic resources.

Mail That Mother Earth Can Love. The U.S. Postal Service produced a brochure by this title to explain what each person can do at work or home to help the mail and Mother Earth. The brochure contains the following tips for business mailers:

- Design recyclable mailings by using uncoated paper stocks, water-based inks, and envelopes with water-based adhesives and recyclable windows or no windows at all;
- Support recycled-products industries by dealing with suppliers that use environmentally sound products, papers, and packaging;
- Use environmentally friendly packing materials;
- Print on both sides of paper;
- Reuse and recycle packaging materials;
- Target mailings; and
- Reduce the amount of undeliverable mail by keeping addresses current.

EPA and the Postal Service joined forces to produce posters promoting the "New 3Rs—Reduce, Reuse, Recycle." In September 1992 the posters appeared in postal lobbies throughout the country, and a multilingual design was

distributed to foreign postal administrations.

Goal 8. Reach beyond national boundaries.

Because environmental risks transcend political boundaries, international information exchanges and joint training ventures have become an environmental education priority, and federal agencies are supporting initiatives around the world.

Sport Fishing Education. Under provisions of the Federal Aid in Sport Fish Restoration Act, up to 10 percent of federal funds apportioned by the Fish and Wildlife Service to the states may be used for aquatic resources education. Such programs can include aquatic ecology, aquatic resources management, aquatic safety, conservation ethics, and fishing. The audience is U.S. fishermen and those from other nations fishing in U.S. waters.

Trilateral Memorandum of Understanding. The United States developed a Trilateral Memorandum of Understanding on Environmental Education in cooperation with the governments of Canada and Mexico to promote environmental education on the North American continent. Educational activities include information exchanges on educational policies, approaches, and materials; support and participation in seminars, workshops, and conferences; and trilateral initiatives involving the environmental education of youth.

Fulbright Fellowships. The U.S. Information Agency and EPA are developing Fulbright Fellowships for senior research scholars in environmental research and education from the Near Eastern, North African, and South Asian regions. Senior scholars will be eligible for 9-month to 1-year grants to further their environmental studies at an institution of higher education.

International Public-Private Partnerships. Federal agencies are supporting public-private initiatives to

State of Maryland.

Maryland's Chesapeake Bay License Plate Program funds environmental education and restoration projects.

promote environmental education in various regions of the world. For example, EPA is sponsoring the Regional Environmental Center for Central and Eastern Europe, initiated in 1990 in Budapest, Hungary; the Caribbean Environment and Development Institute, initiated in 1992 in Puerto Rico; and the Environmental Education and Information Center, initiated in 1992 in Kiev, Ukraine.

The Department of the Interior also is assisting the government of Hungary in developing a free-market-based mineral development program. Assistance includes training in process and techniques for assessing the potential environmental effects of mineral development. The objective is to provide the basic tools for including consideration of environmental values in decisionmaking.

Energy

Also see Federal Facilities Management, International Issues, Technology, Transportation, and related tables and figures in Part II.

The quality of the environment has become closely linked to energy use. In 1992 the federal government expanded energy initiatives to improve environmental quality and energy security and to stimulate economic growth. The basis for the initiatives is the National Energy Strategy (NES) issued by the President in February 1991 as a blueprint for the energy future of the United States. During 1991 and 1992 the federal government introduced over 90 NES initiatives, including the following:

- Expanded energy efficiency and renewable energy programs,
- Increased funding for advanced transportation technologies,
- Expanded interagency efforts in the U.S. Global Change Research Program, and
- Formed partnerships among federal agencies, industries, and states to reduce energy and water use.

The National Energy Strategy Act of 1992, enacted by the Congress and signed by President Bush in October 1992, allows implementation of a balanced, pro-environment, pro-growth national energy strategy.

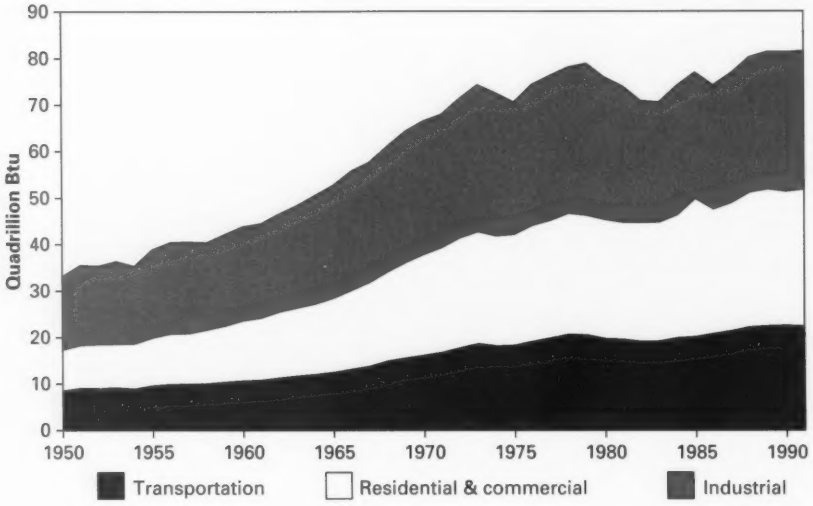
Conditions and Trends

Energy is essential for economic production and the high standard of living Americans enjoy. Over the past two decades, the nation has learned to use energy more efficiently in every sector. The United States uses 10 percent more energy today than it did in 1973, yet there are 30 percent more homes, 50 percent more vehicles, and the gross domestic product is 50 percent higher. The challenge is to produce and use energy more efficiently and cleanly. Implementation of NES promises to improve the way the United States produces and uses energy.

Energy Consumption

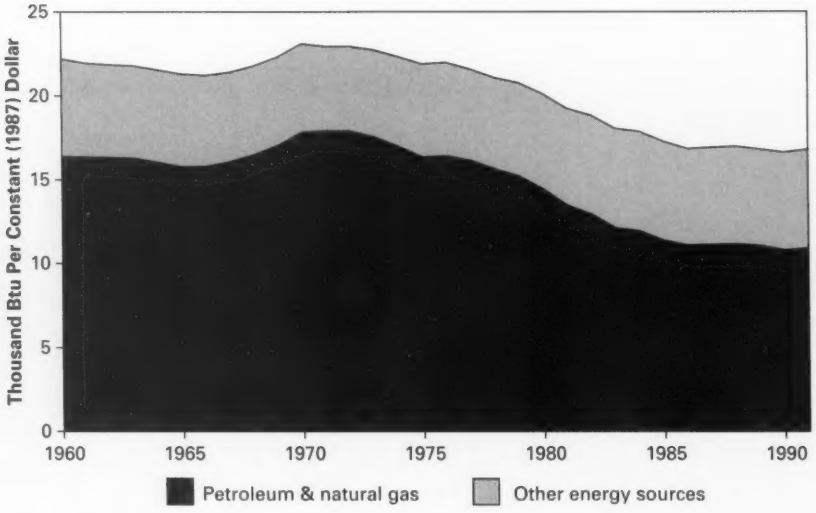
Americans depend on energy to produce goods and services in the following end-use sectors:

U.S. energy consumption, by end-use sector.



Source: See Part II, Table 22.

U.S. energy consumption, per dollar of GNP.



Note: GDP = gross domestic product.

Source: See Part II, Table 24.

Residential and Commercial. This sector accounts for 36 percent of U.S. end-use energy consumption; 35 percent of which is currently in the form of electricity. As the number of electrically heated and cooled homes and buildings expands, the Department of Energy (DOE) expects residential and commercial demand for electricity to rise to over half the total end-use energy demand for this sector by the next century.

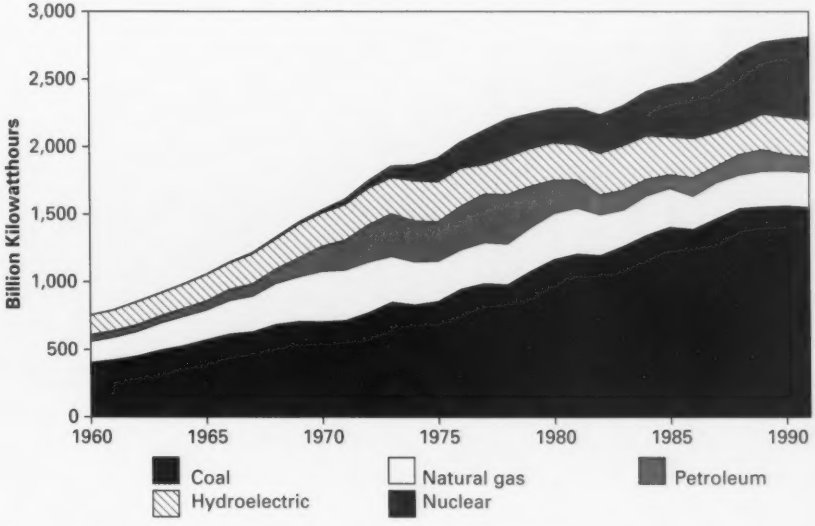
Industry. Industry accounts for another 36 percent of end-use energy consumption, relying on a mix of fuels. Industry uses 70 percent of the energy it consumes to provide heat and power for manufacturing. DOE expects industrial energy demand to grow steadily over the next two decades. During this period, however, energy use per dollar of economic output may decline as a result of energy efficiency improvements. Industry also will increase its generation of electricity and steam for its own use.

Transportation. The United States devotes 27 percent of its energy consumption to the transport of people and goods. Virtually all of this energy consists of petroleum products used to power automobiles, trucks, ships, airplanes, and trains. The transportation sector accounts for two-thirds of U.S. petroleum use. While the number of alternative-fueled vehicles will rise in the future, petroleum fuels likely will continue to dominate transportation energy use for the next 20 years.

Energy Production

U.S. domestic energy resources are extensive and diverse, with coal, oil, natural gas, and uranium found in significant quantities within U.S. borders. Unconventional sources, such as coalbed methane, are also potential future

Sources of U.S. electricity.



Source: Part II, Table 19.

energy sources. Renewable energy sources, such as geothermal, solar, and wind, are available and limited only by the cost-effectiveness of technologies to harness them.

The value of electricity to the U.S. economy continues to increase. By 2010 DOE estimates that 41 percent of the primary energy consumed in the United States will be used to generate electricity, up from 36 percent in 1992. The nation currently uses coal to generate 55 percent of the electricity it consumes; nuclear power supplies 20 percent; and the remainder is generated from oil, natural gas, and renewable energy.

Petroleum. Production of crude oil and refined products accounts for a fourth of U.S. annual energy production. Over 40 percent of the crude oil used in the United States is imported—much of it from politically volatile regions of the world such as the Persian Gulf, which holds two-thirds of known global oil reserves. DOE expects demand for petroleum to increase, even if petroleum prices increase significantly. U.S. production of crude oil, however, is on a steady decline, which will mean greater use of imports in the future to meet demand.

Natural Gas. Natural gas accounts for another fourth of U.S. annual energy production. Natural gas reserves are found in several areas of the United States, and supplies are transported via pipeline. DOE expects consumption of natural gas to increase considerably over the next 20 years, with the bulk of gas demand met by domestic supplies.

Coal. American coal reserves are the largest in the world and supply a fourth of U.S. energy consumption. Nearly nine-tenths of domestic coal use is for electricity generation at large power stations. DOE expects consumption of coal for electricity generation to grow as demand for electricity rises over the next two decades.

Nuclear. Nuclear power supplies 20 percent of all U.S. electricity generation. While eight plants were under construction in 1992, no new nuclear powerplants are on order, primarily because of regulatory uncertainty, costs, and concern over nuclear waste disposal and safety. Unless these issues are resolved, the contribution of nuclear power to national energy needs is unlikely to increase.

Renewables. Renewable energy sources, including hydropower, solar, biomass, municipal wastes, wind, and geothermal energy, provide less than 10 percent of U.S. annual energy production, with hydropower as the leading source. Although half of U.S. renewable energy goes to generate electricity, the nation also uses biofuels for transportation and solar energy to heat buildings and water. Over the next 20 years, DOE expects the use of renewable fuels to increase gradually to meet more than 11 percent of U.S. energy demand.

Environmental Impacts

Over the last two decades, the United States has reduced energy-related air pollutant emissions, primarily with controls mandated by the Clean Air Act. The Clean Air Act Amendments of 1990 promise further reductions.

Lead. Between 1970 and 1990, emissions of lead declined 97 percent as a direct result of its removal from gasoline.

Particulate matter and sulfur dioxide. Over the same period, nationwide emissions of particulate matter (PM) decreased by 59 percent and sulfur dioxide emissions decreased by 26

percent. Such decreases resulted primarily from stringent controls on industrial processes and on such fuel combustion sources as electric utilities and industrial, commercial, and residential boilers. A quarter of the PM decline and a third of the sulfur dioxide decline resulted from controls on coal-fired fuel combustion sources.

Nitrogen oxide. In conjunction with an 83-percent increase in electricity generation between 1970 and 1990, nitrogen oxide emissions from electric utilities increased by 67 percent.

Carbon monoxide and volatile organic compounds. A nationwide 41-percent decrease in carbon monoxide and 31-percent decrease in volatile organic compounds resulted primarily from controls on new motor vehicles.

Carbon dioxide. In 1988 U.S. carbon dioxide emissions totaled 1.3 billion metric tons, a 20-percent increase over 1970 and a reflection of the increase in population and energy use in that period. During the same period, the contribution of coal to total carbon dioxide emissions increased from 22 percent to 38 percent.

Policies and Programs

The National Energy Strategy Act of 1992 could change the American way of life by improving energy efficiency, ensuring the availability of energy supplies, and improving environmental quality. In 1992 the Bush administration implemented NES initiatives and expanded energy assistance to state and local governments. Federal agencies also implemented the President's Executive Order on Federal Energy Management. For a discussion of the Executive Order, see the Federal Facilities Management section. The following are highlights of progress made in 1992.

Superclean Coal and Liquid Fuels

During the fourth round of the Clean Coal Technology (CCT) Program in 1991, DOE added nine demonstration projects for co-funding with industry. Of 42 current CCT projects, 3 have been completed, 10 are in operation, 9 are under construction, and 20 are in the preconstruction design phase. The first four rounds of CCT represent a federal research and development (R&D) investment of $2 billion and an industry investment of $3 billion. The President's fiscal 1993 budget requested $500 million to fund the fifth round of the CCT program.

In 1992 DOE focused its coal R&D program on the super-clean high-efficiency power generation systems needed for coal to compete as an energy source under stringent environmental requirements scheduled to take effect after the year 2000. The DOE goal is to assist the private sector in developing and producing high-quality coal-derived liquid fuels competitive with oil priced at less than $30 per barrel.

Renewable Energy

The President requested fiscal 1993 funding for renewable energy R&D at $250 million, a 65-percent increase over funding in fiscal 1989, the first year of the Bush administration. Increased R&D will accelerate application of emerging renewable energy technologies, reduce costs, improve performance, and make these technologies more competitive in the marketplace.

National Renewable Energy Laboratory. In September 1991 the President designated the Solar Energy

U.S. renewable energy consumption.

Sector and source	Consumption		
	1988	1989	1990
		quadrillion Btu	
Residential, commercial, industrial			
Biofuels*	3.09	2.83	2.78
Hydropower	0.03	0.03	0.03
Geothermal	0.13	0.14	0.16
Ocean thermal	0.00	0.00	0.00
Solar energy			
Thermal	0.09	0.04	0.04
Photovoltaic	0.00	****	****
Wind	0.03	0.02	0.02
Transportation			
Biofuels			
Alcohol fuels**	0.06	0.07	0.10
Electric utilities			
Biofuels***	0.02	2.74	2.89
Hydropower	2.64	2.88	2.94
Geothermal	0.22	0.20	0.18
Ocean thermal	0.00	0.00	0.00
Wind	****	****	****
Total renewable energy	6.31	6.09	6.22

* Includes wood, landfill, and sewer gas, municipal solid waste, and waste heat from biomass sources.
** Includes ethanol and methanol produced from biomass sources.
*** Includes electricity generation from utility wood and waste plants.
****Less than 0.005 quadrillion Btu.

Source: Energy Information Administration, *Annual Energy Review, 1991,* (Washington, DC: EIA, 1992), Table 107, page 243.

Research Institute in Golden, Colorado, as the National Renewable Energy Laboratory. By elevating this facility to national laboratory status, the Bush administration demonstrated a commitment to renewable energy technology.

Solar Thermal Power. In October 1991 DOE entered into a joint venture with a U.S. engine manufacturer to develop a system that uses solar energy to operate a generator capable of providing 5 kilowatts of electricity at an estimated cost of 15 cents per kilowatt hour. This system, scheduled for commercialization in five years, could replace remotely located diesel engines for electricity generation worldwide. The President requested $27 million for solar thermal R&D in the fiscal 1993 budget.

Wind Energy. DOE completed construction of a full-scale blade-and-materials fatigue testing facility at the Wind Energy Test Center at Boulder, Colorado. The wind energy industry uses the center to test improvements aimed at increasing the durability and life of wind turbines. Through R&D at the National Renewable Energy Laboratory, DOE demonstrated a 15- to 30-

C.J. Allen, New England Electric.

Energy efficient lighting saves money as well as power resources.

percent improvement in the performance of wind turbine airfoils compared with those currently available. With such advances in technology, wind energy is on the verge of becoming a competitive resource for electricity generation in many areas of the country. The President requested $22 million for wind energy R&D in the fiscal 1993 budget.

Alternative Fuels

The President's fiscal 1993 budget proposed $15 million to accelerate the acquisition of new vehicles that operate on fuels other than gasoline and the conversion of current vehicles. Funding would allow the purchase and conversion of an additional 5,000 alternative-fuel vehicles (AFVs). For more information on AFVs, see the Federal Facilities Management section.

U.S. Advanced Battery Consortium. In October 1991 the President announced a 4-year $260 million joint research venture with the nation's three largest automakers and others to develop a new generation of batteries for high-performance electric vehicles. These new batteries will be lightweight and capable of increasing significantly the range of electric vehicles. This government-industry effort to address a major technological challenge is strengthening the U.S. position in the international competition for electric vehicle development.

Hybrid Vehicles. Proposed 1993 funding of $20 million would create a new government-industry consortium

S. Biddle, The White House.

President Bush signs the 1992 Energy Bill, as Secretary of Energy James D. Watkins and a group of oilmen look on.

Highlights of the 1992 Energy Bill

At the height of the Persian Gulf war, with national security implications over U.S. reliance on foreign oil at their peak, the President unveiled a U.S. National Energy Strategy—more comprehensive and balanced than any that preceded it. Nineteen months later, after extensive negotiations with the Congress, President Bush signed the Comprehensive National Energy Policy Act into law to implement his energy strategy. The highlights of the 1992 Energy Bill, with its equal measures of energy conserved and energy produced, are described on the facing page.

for hybrid-vehicle technology, based on the model of the Advanced Battery Consortium. This new generation of vehicles would use batteries in combination with other systems, such as fuel cells or gas turbines.

Biofuels. Proposed 1993 funding for DOE biofuel R&D for transportation was $48 million, a 35-percent increase over fiscal 1992 and a 60-percent increase over 1991. In 1991 the departments of Energy and Agriculture signed a memorandum of understanding to coordinate federal efforts in the area of biomass research. The National Renewable Energy Laboratory signed a cooperative R&D agreement with a corn-ethanol producer to test a process that converts corn cellulose into ethanol. DOE signed a similar cooperative agreement with a major oil company to explore ethanol production from waste paper.

Energy Conservation and Efficiency

The President proposed increased funding for energy conservation R&D in the fiscal 1993 budget with a request of $330 million. This represents a doubling of DOE conservation R&D funding since 1989.

Industrial Energy Audits. In 1991 DOE added five Energy Analysis and Diagnostic Centers (EADCs) at

Highlights of the 1992 Energy Bill, (continued)

- **Energy Efficiency.** New standards for improving energy efficiency in homes, offices, utilities, and factories.
- **Alternative Fuels.** Ensuring greater production and use of alternative fuels such as compressed natural gas, propane, ethanol and electricity for automotive transportation use. For example, in 1993, the federal automotive fleet will purchase at least 5,000 new alternative fuel vehicles; 10,000 in 1995; and by the year 2000, 75 percent of the federal fleet will be alternatively fueled.
- **Market-Based Sources of Electricity.** Major overhaul of the nation's electricity-producing law, known as the Public Utility Holding Company Act (PUCHA), to spur competition, reduce regulation, and create new market-based sources of electricity.
- **Nuclear Powerplants.** Streamline the federal licensing of nuclear powerplants to allow for one-stop permitting for construction and operation.
- **Strategic Petroleum Reserve.** Allow for more flexibility in the administration of the strategic petroleum reserve to avoid severe disruptions in the petroleum market that would cause unwarranted price increases.
- **Energy Technology.** Establish a research strategy for energy technology development and transfer.
- **Greenhouse Gas Emissions.** Directs the Energy Information Administration to establish a baseline inventory of greenhouse gas emissions and outlines the basis for a voluntary system for private sector reporting on emissions.

U.S. universities, bringing the total of these centers that conduct energy audits to 18. To date, 3,600 EADC audits, conducted at a cost of $18 million, have resulted in $400 million in energy savings to industry. DOE has initiated discussions with industries, states, and electric and natural gas utilities on ways to improve industrial energy audit techniques. The Department is participating with the Electric Power Research Institute and several utilities in an audit program for selected large industrial firms. Industrial energy audits are a first step in determining where efficiency improvements are most desirable and cost-effective.

Energy-Efficient Buildings. DOE expanded support for R&D on a range of energy efficient building technologies. Working with the Department of Housing and Urban Development on a DOE-HUD Initiative for Energy Efficiency in Housing, DOE funded efforts to increase energy efficiency in HUD-aided housing and to help reduce utility costs of $2 billion per year. Areas of interest include home energy rating systems, energy-efficient mortgages, energy performance contracting in public housing, energy standards for manufactured housing, and guidelines for making Native American housing more energy efficient.

Integrated Resource Planning. DOE also increased funding for Integrated Resource Planning (IRP) to develop better analytical capabilities and to support state and local resource planning programs. The Department is evaluating 50 proposals from utilities and state regulators in response to a solicitation issued through the DOE Oak Ridge National Laboratory for IRP research.

Community Energy Systems. In 1992 HUD funded localities performing feasibility studies on preliminary designs for potential Community Energy Systems. Such systems provide reasonably priced energy for heating and cooling to businesses, industries, and residences. The goal is to foster community and economic development, maximize fuel efficiency, and reduce pollution.

Energy Production

During 1992 DOE received energy production proposals that included developing the Alaskan North Slope and sought Outer Continental Shelf leasing.

Alaskan North Slope Development Task Force. In 1992 the interagency Task Force on Alaskan North Slope Development began considering approaches to reduce regulatory and technical barriers to environmentally responsible development of northern Alaska. Among the barriers under analysis are restrictions on causeway and pipeline construction and difficulties in recovering heavy oil at low temperatures. Targeted fields have the potential to yield 1 billion barrels of oil.

Outer Continental Shelf Leasing. In February 1991 the Department of the Interior issued a draft proposal for a 5-year 1992-1997 leasing plan for the Outer Continental Shelf (OCS). The proposal reflects the President's call for a more targeted OCS leasing program fully supported by scientific studies and sensitive to the concerns and needs of local areas. The plan would increase efforts to gather information on environmental and natural resources and to respond to the views expressed by states, local governments, and the public.

National Technology Initiative

In February 1992 the federal government launched the National Technology Initiative (NTI), with participation by DOE, the Department of Commerce, the National Aeronautics and Space Administration (NASA), and the Department of Transportation. NTI promotes rapid commercialization of advanced technologies, including energy and environmental technologies. For more information, see the Technology section.

Enforcement

Also see National Environmental Policy Act and related tables and figures in Part II.

Strong enforcement supports environmental progress in two ways: by correcting specific violations of environmental law and, more generally, by deterring potential violations. Firm and fair enforcement ensures a level playing field for private-sector competitors and spurs polluters to look beyond mere compliance to preventing pollution in the first place.

In 1992, continuing a 3-year trend, civil and criminal penalties for federal environmental violations reached an all-time high. This trend likely will continue, since the Pollution Prosecution Act of 1990 authorized additional civil and criminal investigators for the Environmental Protection Agency (EPA) through 1995. In addition, EPA and the Department of Justice (DOJ) introduced new enforcement techniques and market incentives to gain the greatest environmental benefits as rapidly as possible.

Conditions and Trends

To implement an Enforcement Four-Year Strategic Plan, EPA pursued a risk-based approach to environmental enforcement. The plan has the following objectives:

- Identify violations that involve the most significant environmental and health risks;
- Employ, where appropriate, several statutes in an integrated, comprehensive enforcement action;
- Use innovative enforcement tools such as environmental auditing to promote pollution prevention; and
- Choose enforcement actions that maximize the deterrent effect on other potential violators.

Historically most environmental enforcement has been media-specific, focusing, for example, on violations

Highlights of Environmental Enforcement

In the Exxon *Valdez* case, the federal government collected the criminal penalty and the first payments of the civil settlement—the largest environmental settlement in history. In 1992 environmental enforcement escalated over previous years with the following accomplishments:

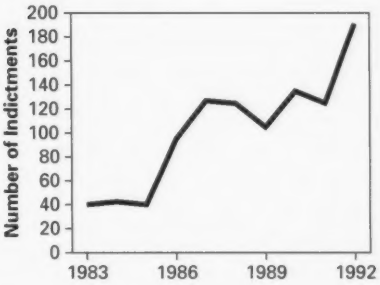
- For the fourth straight year, the value of civil, administrative, and judicial enforcement efforts exceeded $l billion, with the figure for 1992 approaching $2 billion;
- Civil judicial enforcement actions returned $41 for every $1 spent; with each DOJ environmental enforcement attorney averaging $12.6 million in civil penalties, natural resource damages, CERCLA (Superfund) cost recovery, and commitments to site cleanup work by defendants.
- Civil penalties came to $65.6 million, doubling the previous record of $32.5 million in fiscal 1991;
- Recoveries for natural resource damages rose from $45 million in fiscal 1991 to $923 million in fiscal 1992;
- A record number of criminal indictments, 174, were handed down; and criminal enforcement set a record of $163 million in fines, restitution, and forfeitures, including $125 million from the Exxon plea; and
- Of jail time imposed, 91 percent was served.

The following achievements in the federal criminal enforcement program had major deterrent effects:

- The Rockwell Corporation agreed to pay the largest Resource Conservation and Recovery Act (RCRA) criminal fine in history, $l8.5 million, for RCRA and Clean Water Act felonies in managing hazardous wastes at the Department of Energy facility at Rocky Flats, Colorado.
- Chevron pled guilty to 65 Clean Water Act violations, paying $8 million in civil and criminal fines ($6.5 million in criminal)—the third largest criminal penalty assessed under any environmental statute.

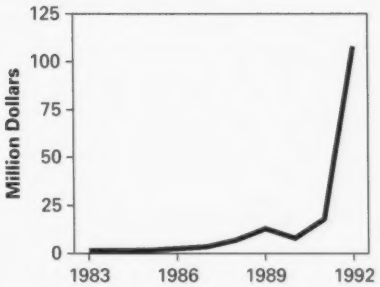
affecting air or water in specific locations. A large part of the enforcement effort will continue to be media-specific, seeking penalties through provisions of the Clean Air Act (CAA), Clean Water Act (CWA), RCRA, or other statutes. However, these media-specific priorities increasingly will be supplemented by targeted multimedia initiatives to deal with violations caused by specific pollutants or industries across entire geographic areas and ecosystems. For example, multimedia cases were filed in 1992 affecting benzene emissions, the import and export of hazardous wastes, pulp and paper manufacturing, metal manufacturing and smelting, organic chemical manu-

Federal indictments for environmental crimes.



Source: U.S. Department of Justice, Environmental Crimes Division, Washington, DC, 1992.

Federal fines collected for environmental crimes.



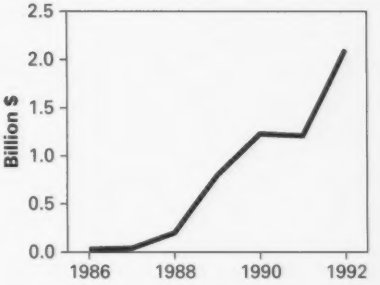
Note: The 1992 figure does not include $55 million in criminal fines that went to the states, primarily $50 million to Alaska in the Exxon *Valdez* case; the federal-state total would be $163 million.

Source: U.S. Department of Justice, Environmental Crimes Division, Washington, DC, 1992.

facturing, and cleanups along the U.S.-Mexico border.

Because of the vast number of potential prosecutions, the federal government encouraged greater self-auditing and policing by regulated entities. In 1991 DOJ announced an environmental audit policy that views such voluntary actions as mitigating factors in the exercise of enforcement discretion. Responding to the concern that aggressive enforcement might deter voluntary self-audits and disclosure, the policy describes the factors DOJ considers in bringing criminal prosecutions.

Dollar value of federal environmental enforcement actions.



*Includes civil penalties, settlements, cost recoveries, and injunctive relief; for the latter, data is not available prior to 1988.

Source: U.S. Department of Justice, Natural Resources and the Environment Division, Washington, DC, 1992.

Policies and Programs

The following are highlights of federal environmental enforcement in 1992.

Multimedia Enforcement

EPA has modified procedures for inspecting facilities and for screening to identify cases for multimedia enforcement. To provide the capability to find patterns of noncompliance within or across environmental media, EPA developed a system linking various compliance databases and made it available for use by the states. Major multimedia enforcement efforts in 1992 are described here:

Industrial Enforcement. EPA launched the first coordinated enforcement initiative involving specific industrial sectors. On September 10, 1992,

EPA and DOJ filed a series of enforcement cases against industrial facilities in the pulp and paper manufacturing, metal manufacturing and smelting, and industrial organic chemical manufacturing sectors—sectors which EPA identified as having a significant incidence of noncompliance with environmental standards and large amounts of reported releases of toxic substances to the environment.

The 22 civil and administrative enforcement actions filed involved violations of several environmental statutes including the CWA, RCRA, CAA, Toxic Substances Control Act, and Emergency Planning and Community Right-to-Know Act. By concentrating enforcement authorities on noncompliant industries, EPA expects to increase compliance rates with all environmental statutes throughout these industrial sectors and to foster greater use of pollution prevention, pollution reduction, and other innovative solutions to compliance problems.

Benzene Initiative. On August 5, 1992, EPA and DOJ announced the settlement of a $1 million benzene enforcement action against a Chevron petroleum refinery in Philadelphia. The settlement was by far the largest penalty to date obtained for violations of hazardous air pollutant standards for benzene. At the same time, EPA and DOJ entered into a settlement with a Sharon Steel plant in Monesson, Pennsylvania, for a benzene-related civil action.

EPA also instituted seven administrative enforcement actions against companies alleged to be in violation of federal requirements aimed at preventing releases of benzene into the environment. These simultaneous filings under the CAA, RCRA, and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA also known as Superfund), signaled an EPA crackdown on violators of environmental standards designed to protect air, water, and land from the hazards of benzene pollution.

Mexican Border. In June 1992 EPA announced the first enforcement actions in the United States resulting from efforts outlined in the Integrated Environmental Plan for the U.S.-Mexico Border Area. A total of 17 federal and state actions against facilities on the border sought $2 million in penalties. These actions involved two criminal indictments and ten civil actions for violations of federal air, toxic substance, community right-to-know, and waste laws.

Bankruptcies. The federal government used a coordinated multifacility, multimedia approach to environmental enforcement when companies with violations or liabilities at numerous sites filed for bankruptcy and sought to require the government to adjudicate environmental claims during the course of the bankruptcy proceeding. In 1992 the United States was involved in two complex estimation hearings involving Superfund sites: *In re National Gypsum Co.*, (N.D. Tex.) involved four Superfund sites, and *In re CF&I Fabricators of Utah, Inc.*, (D. Utah). The federal government also entered into comprehensive settlements for *In re U.E. Systems, Inc.* (N.D. Ind.) and *In re Insilco Corp.* (W.D. Tex.), which resolved claims at numerous Superfund sites and provided a mechanism for addressing future claims arising from pre-bankruptcy conduct.

Media-Specific Enforcement

The following are highlights of 1992 media-specific enforcement.

Federal administrative enforcement actions, by environmental law.

Fiscal Year	CAA	CWA/* SDWA	RCRA	CERCLA	FIFRA	TSCA	EPCRA	TOTAL
1972	0	0	—	—	860	—	—	860
1973	0	0	—	—	1,274	—	—	1,274
1974	0	0	—	—	1,387	—	—	1,387
1975	0	738	—	—	1,614	—	—	2,352
1976	210	915	0	—	2,488	0	—	3,613
1977	297	1,128	0	—	1,219	0	—	2,644
1978	129	730	0	—	762	1	—	1,622
1979	404	506	0	—	253	22	—	1,185
1980	86	569	0	0	176	70	—	901
1981	112	562	159	0	154	120	—	1,107
1982	21	329	237	0	176	101	—	864
1983	41	781	436	0	296	294	—	1,848
1984	141	1,644	554	137	272	376	—	3,124
1985	122	1,031	327	160	236	733	—	2,609
1986	143	990	235	139	338	781	0	2,626
1987	191	1,214	243	135	360	1,051	0	3,194
1988	224	1,345	309	224	376	607	0	3,085
1989	336	2,146	453	220	443	538	0	4,136
1990	249	1,780	366	270	402	531	206	3,804
1991	214	2,177	364	269	300	422	179	3,416
1992	294 **	1,977	291	245	311	355	134	3,607

* Includes administrative orders for wetlands.
** 1992 CAA actions are not final.

Notes: Public Water Systems (PWS) actions under SDWA and asbestos demolition and removal actions under CAA are reported on a first-quarter lag; final fiscal 1992 administrative order totals for these programs will be reported in the first quarter of fiscal 1993. CAA = Clean Air Act; CWA/SDWA = Clean Water Act/Safe Drinking Water Act; RCRA = Resource Conservation and Recovery Act; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act (Superfund); FIFRA = Federal Insecticide, Fungicide, and Rodenticide Act; TSCA = Toxic Substance Control Act, EPCRA = Emergency Planning and Community Right to Know Act (Title III, Superfund Amendments and Reauthorization Act of 1986).

Source: U.S. Environmental Protection Agency, Office of Policy, Planning, and Evaluation, Washington, DC, 1992.

Air. In addition to implementing the Clean Air Act Amendments of 1990, EPA settled several major cases and recovered $15 million in penalties. For example, in a case against Bethlehem Steel, EPA addressed unlawful emissions presenting significant risks to human health and the environment in densely populated areas of Pennsylvania. The action significantly reduced benzene emissions and recovered $5 million, a record monetary settlement in stationary-source enforcement.

In addition, on May 20, 1992, EPA announced the coordinated nationwide filing of over 50 Clean Air Act administrative penalty cases. Filed in 26 states and Puerto Rico, the cases enforced var-

ious Clean Air Act provisions and regulations, including new requirements for continuous emissions monitoring equipment at petroleum refineries, national emissions standards for asbestos, benzene and uranium mining waste piles, and state standards for smoke density and airborne particle emissions. The initiative helped inform the regulated community of the new administrative penalty authority granted to EPA under the Clean Air Act Amendments. This authority is one of several new enforcement tools provided to EPA by the amendments.

Hazardous Waste. Increased and consistent environmental enforcement has reduced instances of deliberate improper waste disposal. Companies now carefully investigate brokers and waste disposal operations before dealing with them, and disposal companies carefully sample and inspect what they receive. This extra care in the system reflects vigorous enforcement of RCRA requirements and of the Superfund liability scheme.

- **Illegal Operator Initiative.** In 1992 EPA, through a RCRA enforcement program, targeted facilities that failed to provide required notification to the federal government regarding their handling of hazardous wastes. Non-notifiers included violators of the new toxicity characteristic rule. On February 4, 1992, EPA announced the Illegal Operator Initiative, which consists of 27 federal administrative cases and 24 state civil actions. In this effort, the first federal hazardous waste enforcement initiative to include state cases, the governments assessed $20 million in total penalties. EPA also announced federal criminal enforcement actions, including five guilty pleas and six indictments involving hazardous waste violations.
- **Superfund Response Work.** Under CERCLA, EPA has broad enforcement powers to protect human health and the environment from hazardous substances releases. The proportion of Superfund response work conducted through enforcement actions has grown steadily since CERCLA was amended in 1986. In 1992 responsible parties accounted for two-thirds of new Superfund response actions being obtained by EPA, up from 38 percent three years ago. The total amount of response work obtained from responsible parties now exceeds $5 billion, with recoveries for each of the past two years exceeding $1 billion. Each dollar spent for enforcement has produced $8 in response work or cost recovery.
- **CERCLA Settlements.** In fiscal 1992 DOJ entered into a series of settlements—valued at $285 million—in three major Superfund lawsuits that were first filed in the infancy of hazardous waste litigation—(Midco in 1979 and Stringfellow and AVX in 1983). In succeeding years, the cases were heavily litigated. In *United States v. Midwest Solvent Recovery, Inc.* ("Midco") (N.D. Ind.), the settlement involved implementing hazardous waste cleanups at the Midco I and II sites in Gary, Indiana, reimbursement of the United States for past costs, and payment of a fine for noncompliance with an administrative order. The settlement in *United States v. J.B. Stringfellow, Jr.*, (C.D. Cal.), was valued at $150

million and covered past costs and injunctive relief. In *United States v. AVX Corporation, et al.* (D. Mass.), the settlement involved cleanup of PCB contamination and restoration of New Bedford Harbor.

• **NPL Sites.** In another Superfund development, a federal district court upheld EPA authority over that of states to set cleanup priorities and choose final remedies at federal facilities on the National Priorities List (NPL) (*United States v. State of Colorado, et al.* (D. Colo. 1991)). The case is now on appeal to the United States Court of Appeal for the Tenth Circuit. If upheld, this decision will expedite decisionmaking and decrease time-consuming litigation over CERCLA sites at federal facilities.

Toxics. To protect human health and the environment from harmful substances, a number of federal agencies cooperate on enforcement actions. A sampling follows of cooperative efforts by such agencies as EPA, the Occupational Health and Safety Administration (OSHA), the Food and Drug Administration (FDA), the Department of Agriculture, and the U.S Customs Service.

• **Toxic Exports.** EPA, with FDA input, sets permissible tolerances for pesticide residues on food products. FDA is responsible for analyzing food imported into the United States, and EPA is responsible for ensuring that any pesticides exported from the United States meet certain export requirements. In the past, the agencies have found beef, winter fruits, and even coffee to be contaminated with toxic pesticides. Existing pesticide export requirements include bilingual labeling instructions to promote foreign worker protection and proper pesticide applications and foreign purchaser acknowledgments, issued to EPA and the nation of destination and use. These requirements help prevent illegal or unwanted American pesticides from being illegally exported or improperly used. In the past two years, EPA enforcement actions against exporters collected $700,000 in fines.

• **Food Safety.** To set food residue tolerances, FDA and EPA rely on timely and accurate data submitted by pesticide manufacturers. Residue data analyses allow EPA to make scientific judgments regarding the long-term fate or degradability of certain commercial chemicals as used in actual field situations. In 1991, as part of the National Food Basket Survey, EPA discovered that pesticide residue data for more than 25 registered chemicals appeared to be unreliable and might have been deliberately falsified. On August 25, 1992, following an extensive investigation, EPA and DOJ announced the indictment of the president of Craven Laboratories, in Austin, Texas, along with indictments or criminal informations for ten present and former staff members of the lab. Data for more that 200 pesticide residue studies may turn out to be suspect.

• **Worker Health.** Workplace injury from chemicals and chemical exposure remains a serious threat to many Americans. In a formal working relationship, EPA and OSHA focus attention on the potential threats that chemical use, distribution, or disposal create for American workers. The agencies

conduct joint inspections, inspector training, and data exchange on target problem areas. EPA is litigating its first case involving a fatality from a toxic chemical. The violation was failure to report the death to EPA as required by the Toxic Substances Control Act.

• **Asbestos in Schools.** Prior to 1976 many schools were constructed with asbestos because of its fire-resistant properties. When the potential carcinogenic properties of airborne asbestos became apparent, EPA established requirements for schools to develop plans to either remove or manage asbestos in a way that protects human health and worker safety. Many schools, lacking the specialized expertise to develop management plans, retained private contractors to develop school management plans. However, EPA learned that some contractors developed plans that were inadequate for purposes of managing asbestos. One company, Hall-Kimbell, prepared management plans for 20 percent of all school districts in the United States, representing more than 25,000 separate school buildings. Litigation resulted, and, to date, 21 cases have been filed, seeking civil penalties of $6.5 million dollars and correction of each management plan.

• **Chemical Health and Safety Data.** Over 100 companies have registered for the EPA Toxic Substances Control Act Compliance Audit Program. Participating companies voluntarily submit late health and safety reports on chemicals and pay stipulated penalties that average $5,000 per late report. Such penalties are lower than the statutory maximums that EPA could impose. The program has increased compliance with the data-reporting requirement of TSCA and has provided valuable health and safety data. To date, EPA has received 5,500 late reports.

Water. In 1992 EPA enforcement under the Clean Water Act focused on environmental areas with cases of major noncompliance. In addition, EPA regional offices developed geographic enforcement initiatives, such as the Grand Calumet River initiative, which impacted the Great Lakes. Major cases involving CWA enforcement included:

• *United States v. City of Beaumont, Texas* (E.D.Tex). The district court awarded a penalty of $400,000 against the city. The penalty represented the savings to the city of noncompliance ($316,000) and a gravity component ($84,000). The court found that the city had failed to complete key pretreatment tasks on time, including sampling and analysis of industrial users, issuing permits requiring industrial self-monitoring, taking enforcement actions, and publishing a list of significant violators in the newspaper.

• *United States v. Butte Water Co.* (D.Mont.) and *United States v. Silver Bow Water, Inc. et. al* (D.Mont.). In these cases, EPA enforced the Public Water Supply requirements of the Safe Drinking Water Act (SDWA) against larger water systems. On May 15, 1992, the court entered a consent decree, which settled all injunctive relief necessary to ensure that the owners and operators of the drinking water system come into full compliance with SDWA as quickly as possible.

International Cooperation

Recognizing the increasingly transnational aspects of environmental protection, the federal government in 1992 fostered international cooperation in environmental enforcement. Examples of federal efforts follow.

International Treaties. The United States enforces U.S. laws that implement international environmental treaties. To enforce Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL), which prohibits discharge of plastics, the U.S. Coast Guard will bring enforcement actions against ships entering U.S. ports for all suspected violations that occur within the U.S. 200-mile exclusive economic zone. In the area of toxic exports, in June 1992 DOJ brought criminal charges against several companies and individuals for illegal export of hazardous waste to Bangladesh and Australia.

Assistance to Developing Nations. The United States assists developing nations in strengthening their own environmental enforcement capabilities.

Bilateral Linkages. Building bilateral linkages with counterparts promotes cooperation in enforcement in such areas as transboundary pollution, illegal traffic in hazardous wastes and toxic substances, and smuggling of endangered species. In 1991 the United States and Mexico established a Cooperative Environmental Enforcement Work Group to plan and carry out information exchanges and coordinated enforcement actions. In addition to training U.S. and Mexican investigative personnel, EPA is establishing a compliance tracking system to support multimedia environmental enforcement in the U.S.-Mexico border area. DOJ has represented the United States and the International Boundary and Water Commission in judicial proceedings pertaining to the U.S.-Mexico border environment.

Global Networks. The nation is developing global environmental enforcement networks. For example, in 1992 the United States participated in international meetings such as the Twelfth Annual Attorneys General Border Conference, held in Phoenix, Arizona, and the Second International Conference on Environmental Enforcement held in Budapest.

Wildlife and Fisheries

A strong enforcement program in this area continued in 1992.

Black-Market Walrus Ivory. In Alaska, 29 individuals were charged with illegally killing walrus and trafficking in walrus ivory and drugs. An investigation by the U.S. Fish and Wildlife Service found that killings of walrus for their ivory increased after the United States banned the import of African elephant ivory in 1989. A 2-year undercover sting operation revealed a black-market trade in walrus ivory, including the trading of ivory for drugs. To date, 25 of the defendants

have been tried and convicted or have pleaded guilty, typically of multiple felony charges.

Exotic Bird Smuggling. Convictions and guilty pleas to multiple felonies resulted from prosecutions of individuals involved in exotic bird smuggling from Mexico, Australia, and New Zealand into the United States. Additional prosecutions are expected to grow out of the 3-year undercover Operation Renegade.

Fishing Laws. In 1992 the U.S. Coast Guard continued air and surface patrols to detect and deter violations of fishing laws and regulations.

Federal Facilities Management

Also see Department of Defense, Energy, Hazardous and Solid Wastes, Pollution Prevention, and related tables and figures in Part II.

In 1992 President Bush signed into law the Federal Facilities Compliance Act, which waives federal sovereign immunity regarding enforcement actions taken by EPA and the states under the Resource Conservation and Recovery Act (RCRA). EPA and the states now have explicit authority to impose fines and other penalties against federal agencies for hazardous waste violations. The law ensures that federal facilities adhere to the same environmental regulations as the private sector.

Conditions and Trends

The current environmental focus of federal facilities management is pollution prevention, control, and cleanup. Efforts range from recycling office copier paper to multi-billion dollar hazardous waste cleanup programs.

Pollution Prevention

The federal government has endorsed recycling and energy efficiency to benefit the environment and provide cost-savings. Federal facilities are using their purchasing power to develop markets for recycled products and to reduce energy consumption in government buildings.

Pollution Control

Federal agencies continued to clean up hazardous waste sites located at their facilities in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). The National Priorities List (NPL), maintained by EPA to identify the nation's most seriously contaminated toxic waste sites, included 116 sites at federal facilities.

The Department of Defense (DOD) and the Department of Energy (DOE) lead in numbers of NPL sites, although

Executive Orders on Federal Facilities Management

In 1992 federal departments and agencies initiated programs to comply with two executive orders issued by the President in 1991.

Federal Energy Management. Federal facilities took actions to comply with Executive Order No. 12759 signed by the President in April 1991:

- **Energy Use Reduction.** Federal agencies are taking steps to reduce energy use in federal buildings to 20 percent below 1985 levels by the year 2000;
- **Gas and Diesel Reductions.** Federal agencies are reducing gas and diesel use in federal fleets of 300 or more vehicles to achieve a goal of 10 percent below 1991 levels by 1995; and
- **Alternative-Fuel Vehicles.** Federal agencies are moving to procure the maximum practicable number of alternative-fuel vehicles (AFVs) by the end of 1995.

Federal Waste Reduction and Recycling. In October 1991 the President signed Executive Order No. 12780, requiring federal agencies to reduce wastes and increase recycling through the following programs:

- **Waste Reduction and Recycling.** Federal agencies are promoting cost-effective waste reduction and recycling of reusable materials in operations and facilities; and
- **Recycled Products.** Federal agencies are procuring items made from recycled materials in accordance with the Resource Conservation and Recovery Act (RCRA).
- **Recycling Coordinators.** In 1992 the Environmental Protection Agency designated a federal recycling coordinator to assist federal agencies with waste reduction, recycling, and procurement of recycled materials and to report annually to the Office of Management and Budget (OMB) on federal waste reduction and recycling. To date, 50 agencies have named federal recycling coordinators and 36 have submitted status reports on affirmative procurement programs to purchase products made from recycled materials.
- **Council on Federal Recycling and Procurement Policy.** In June 1992 this council, created by the Executive Order, sponsored a 2-day Recycled Products Trade Fair and Showcase. The theme, "Closing the Loop," stressed that until materials recovered from the waste stream are turned into products that someone can use, they have not really been recycled. Over 3,000 vendors demonstrated the diversity and quality of products made with recycled materials and attended workshops with government procurement officers.

U.S. Council on Federal Recycling and Procurement.

At the 1992 Government Buy Recycled Products Trade Fair, federal employees conferred with vendors of recycled products.

other agencies, including the Department of the Interior, Department of Transportation, and General Services Administration, also are cleaning up NPL sites. EPA and the states continued to work with federal agencies to hasten environmental remediation and restoration.

Environmental Planning

In addition to the cleanup of facilities, federal agencies instituted environmental quality goals. To move beyond compliance with environmental regulations, federal agencies took the following actions:

- Collected and monitored baseline environmental information at federal facilities,
- Monitored environmental requirements,
- Assessed environmental management practices and revised as needed,
- Instituted source reduction and waste minimization,
- Instilled an environmental ethic in employees through training and education, and
- Developed and implemented comprehensive environmental audits.

Policies and Programs

Two executive orders issued by the President in 1991—one on waste reduction and recycling at federal facilities and the other on reductions in energy use at federal facilities—set the tone for environmental programs in all federal departments and agencies. The General Services Administration (GSA) is the lead agency for waste reduction, recycling, and energy management by federal facilities. In addition to such GSA programs, federal agencies undertook a number of other environmental projects. A sampling of efforts made by federal facilities in 1992 to comply with the executive orders, to prevent pollution, and to clean up existing pollution follows.

General Services Administration

GSA administers an array of environmental programs, among them, waste reduction, gas and diesel restrictions, recycling and the use of recycled products, CFC reductions, and energy efficiency.

Waste Reduction. Federal agencies are reducing paper consumption by making use of advanced technologies, such as electronic data interchange, computer networks, electronic mail systems, and voice mail. An example is the Multi-User File for Interagency News (MUFFIN) that makes information about supply programs available by computer and modem and has the potential to reduce federal paperwork. MUFFIN could eliminate 350,000 hard-copy documents, ranging from requisitions to discrepancy reports, sent from client agencies to GSA each year. Since 1983 GSA alone has saved 1,604 tons of paper through the use of computer technology. In addition, federal

Alternative-Fuel Vehicles

The U.S. government is purchasing alternative-fuel vehicles (AFVs) in compliance with the Alternative Motor Fuel Act of 1988, the Clean Air Act Amendments of 1990, and the 1991 Executive Order on Federal Energy Management. AFVs are fueled by methanol, compressed natural gas, ethanol, and electric power. Federal agencies plan to purchase an additional 5,000 AFVs by the end of fiscal 1993, to have more than 20,000 federal AFVs operating in 1995, and to have half of the federal fleet in AFVs by 1998.

The U.S. Government is moving forward with its alternative-fuel vehicle program to meet demands for national energy security and reduced emissions. The federal presence helps stimulate the market and establish the groundwork for state and private sector participation in years to come.

U.S. Postal Service. The Postal Service has the nation's largest AFV fleet.

- **Compressed Natural Gas.** With a CNG delivery fleet of more than 1,200 vehicles, the Postal Service in 1992 added CNG-powered vehicles in Staten Island, New York; Tulsa and Oklahoma City, Oklahoma; and Huntington Beach, Sacramento, and Concord, California. Current testing indicates that CNG is the best alternative fuel for the purposes of the Postal Service. Its major advantages over gasoline are savings of about 3 cents per mile; less pollution; better safety record than gasoline; and less vehicle maintenance. Primary disadvantages—initial cost and availability of fueling stations—have limited CNG use to areas where public utilities provide refueling equipment.
- **Electric Power.** The Postal Service and the Ford Motor Company are discussing tests for six electric vans in Southern California, which could begin as early as July 1993.

General Services Administration. In 1992 GSA brought 3,287 original-equipment-manufacturer AFVs into the federal fleet. These vehicles use the following fuels:

- **Methanol Flexible Fuel.** GSA purchased 2,500 methanol flexible fuel compact sedans from Chrysler Corporation and 25 methanol flexible fuel vans from Ford Motor Company in 1992. These vehicles, which operate on methanol (M85), unleaded gasoline, or any combination of the two, will be operating in numerous locations nationwide. GSA previously operated 65 methanol flexible fuel sedans.
- **Compressed Natural Gas.** GSA purchased 600 CNG three-quarter ton pickup trucks from General Motors and an additional 25 CNG 8-passenger vans from Chrysler Corporation in 1992. These vehicles will be added to the GSA fleet of 52 CNG 8-passenger vans operating throughout the nation.
- **Ethanol Flexible Fuel.** GSA operates 25 ethanol flexible fuel General Motors sedans in Washington, D.C., and Chicago. These cars use ethanol (E85), unleaded gas, or any combination of the two.

agencies are using environmentally sound packaging and 2-sided duplicating machines.

Gas and Diesel Restrictions. In 1992 GSA issued a regulation on energy management of motor vehicles in the federal fleet to assist federal agencies that operate 300 or more vehicles to reduce gasoline and diesel consumption 10 percent below fiscal 1991 levels by fiscal 1995. The regulation also mandates the use of a modified life-cycle costing formula when evaluating bids for passenger vehicles and light trucks up to 8,500 pounds.

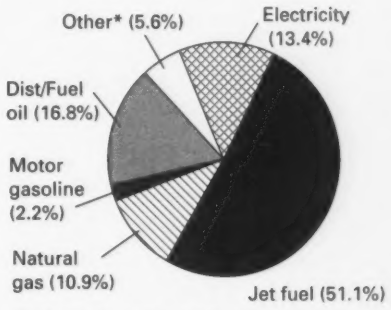
Recycling. In 1991 GSA implemented recycling in 345 buildings owned by the U.S. Government nationwide, involving 400,000 federal employees, recovery of 22,000 tons of recyclable materials, and generation of $500,000 through sales contracts. Reduction in handling and dumping fees resulted in savings of $1 million. In 1992 the programs expanded to 728 buildings owned and leased by the U.S. Government with 500,000 federal employees participating. In addition to recycling wastepaper, GSA is composting vegetative materials and recovering items such as copper wire, carpet, ceiling tile, paint, cardboard, telephone books, and glass and plastic food and beverage containers. In 1992 the program recovered 36,000 tons of material, which represents a 63-percent increase over fiscal 1991.

Recycled Products. To stimulate the U.S. market for recyclables, GSA procured 168,000 tons of recycled content paper and paper products in 1992, including paper towels, toilet paper, cardboard boxes, stationery items, and file folders. GSA awarded 271 contracts for 802 recycled-content paper and paper products totaling $169 million—a third of all paper supplied by the agency. Committed to products with high percentages of post-consumer recovered material, GSA stocked scores of products that exceed guidelines issued by EPA under RCRA. For example, in 1992 GSA introduced as a stock item recycled-content copier paper that is not required by the EPA guidelines. The paper contains 50-percent recycled content, including 10-percent post consumer-recovered material.

Other products include retread bus and truck tires, thermal building insulation products made with 9 to 50-percent recovered materials, and recycled wiping rags, toner cartridges used in office equipment, and paint. In fiscal 1991 GSA awarded 70 contracts for retread bus and truck tires valued at $200,000; in fiscal 1992 the numbers increased to 232 contracts valued at $650,000. Remanufactured toner cartridges that reduce disposal and save 50 percent in replacement costs have resulted in savings for federal agencies of $2 million since 1990.

Federal energy use.

Total (1.43 quads)



*Includes Navy Special fuel, purchased steam, coal, Lpg/propane, and aviation gas (non-jet).

Note: Data are for 1991. Conversion factor for electricity is 3,412 Btu per kilowatt hour.

Source: U.S. Department of Energy, *Annual Energy Review 1991,* (Washington, DC: DOE, 1992).

In 1991 GSA highlighted environmentally sound products in two publications: *GSA Recycled Products Guide*, which lists products available from GSA supply sources and provides a means for agencies to identify and purchase recycled products; and *GSA Supply Catalog*, which highlights stock items with recycled content. In 1992 GSA expanded the catalog to include 2,100 environmentally sound products, such as lead-free, energy-saving, and water-saving items.

Chlorofluorocarbon Reduction. To meet requirements of the Clean Air Act, GSA is eliminating the use of products containing ozone-depleting chemicals. Federal facilities are reducing the use of chlorofluorocarbons (CFCs) in their operations, and they are servicing vehicles in the federal fleet to capture CFCs. After eliminating aerosol paints that used CFCs as a propellant 15 years ago, GSA now has eliminated plastic foam cups manufactured with CFCs. Halon fire extinguishers also are no longer in the federal supply system.

Energy Efficiency. In 1992 GSA continued to develop and implement projects to reduce energy use in buildings owned, operated, or leased by the U.S. Government. In fiscal 1990 GSA spent $10 million on 90 energy conservation projects; in fiscal 1991 those figures had increased to $30 million for 320 projects. In fiscal 1992 GSA approved an additional $37.5 million for 209 projects that include retrofitting existing lighting systems and installing motion sensors to control lighting, energy efficient motors, improved windows, and energy management and control systems. GSA also is replacing heating, ventilation, and air conditioning systems. Such actions have resulted in a 6-percent reduction in energy consumption in the GSA energy program since 1985.

Department of the Interior

In 1992 the Department of the Interior (DOI) expanded a paper recycling initiative at its Washington, D.C., headquarters to include colored paper, newspaper, cardboard, aluminum cans, and glass containers. Through July 1992 DOI headquarters had collected 466.5 tons of high grade white paper, 126.6 tons of grade 2 colored paper, 96.9 tons of newspaper, 50.2 tons of cardboard, 6.3 tons of aluminum cans, 18.5 tons of glass, and 20.5 tons of scrap metal. The paper collection alone represents estimated savings of 2,443 cubic yards of landfill space, 12,583 trees, and 5.2 million gallons of water.

As an additional benefit, the frequency of trash collection and associated landfill costs have been reduced for an estimated annual savings of $63,000. Under the President's Partnership in Education program, DOI donated $942 in proceeds from the collection of aluminum cans and glass containers to its adopted elementary schools in the area to purchase supplies and materials.

U.S. Postal Service

In 1992 the Postal Service integrated environmental strategies with its business activities and revised specifications for retail products. Use of recycled products is gaining momentum in the postal retail product line and in office products. Although current higher procurement costs of recycled copier paper can be an economic disincentive in large orders, greater market demand for such products should lower procure-

ment costs and increase overall purchases. Examples of recycling include the following:

- **Paper Recycling.** In April 1992 the Postal Service undertook a mixed-paper recycling program in the New York metropolitan area, which will reduce hauling and landfill costs significantly. Wastepaper from postal facilities in Manhattan, Long Island, Queens, and the Bronx will be recycled annually into tissues, napkins, and paper towels.
- **Recyclable Windows on Mailing Envelopes.** Plastic windows on mailing envelopes were a roadblock in recycling mail, until development of glassine, a cellulose material that is re-pulpable and can be pasted onto envelopes with a water-based adhesive.
- **Recycling Solid Waste.** In 1992 the Postal Service recycled an estimated 25,945 tons of solid waste materials, 5,676 batteries, 1,941 tires, and 93,553 gallons of antifreeze, ink, solvents, used oil, and photochemicals.

Department of Defense

The Department of Defense is committed to becoming a leader in environmental compliance. A summary of DOD efforts in environmental restoration and pollution prevention follows. For a more detailed discussion, see the Department of Defense section.

Environmental Restoration. In 1992 the Defense Environmental Restoration Program (DERP), operating with a billion dollar budget, improved management and accelerated characterization and cleanup of 1,800 contaminated military sites, 94 of them on the National Priorities List. DOD analyzed cost-reduction initiatives for a comprehensive restoration strategic plan to be completed by 1995.

Pollution Prevention. The DOD pollution prevention strategy emphasizes systems acquisition, material substitution, process improvement, improved hazardous materials management, and alternative energy sources. By instituting control measures, DOD has reduced hazardous waste disposal by over half since 1987. This reduction was achieved despite the increased production and maintenance related to Operation Desert Shield/Desert Storm.

Department of Energy

In 1992 the Department of Energy implemented programs stressing the compatibility of environmental protection and energy production. In addition, DOE had two major efforts underway to improve management of the U.S. nuclear weapons program, which it has supervised for the past 30 years. The agency also proceeded with plans to manage the nuclear waste generated by commercial nuclear energy plants.

Waste Minimization. In May 1992 DOE introduced a plan to coordinate waste minimization at its facilities. Objectives include creating a staff bias for conserving resources and minimizing wastes, identifying waste minimization options and technologies, and incorporating waste minimization principles in design, development, and production.

DOE also published a multi-year plan for support of industrial waste minimization technologies. The department supports technology R&D cost-shared with industry to reduce waste and save energy. In 1991 DOE and industry rep-

Innovative Technology and Federal Facility Cleanup

The departments of the Interior, Energy, and Defense and the Environmental Protection Agency signed a Memorandum of Understanding with the Western Governors' Association in July 1991 to streamline the cleanup of contaminated federal facilities and sites in the West. Under the 5-year agreement, federal agencies and western states will plan and implement demonstrations of innovative technology at federal nuclear facilities, defense bases, abandoned mine sites, and perhaps eventually private sites throughout the western states.

In October 1992 in Denver, the secretary of Energy announced plans for the start up of pilot demonstration projects in 1993. DOE is requesting funding for three to six innovative cleanup projects through the Strategic Environmental Research and Development Program (SERDP). Such projects could become national models, providing the United States with a world lead in restoration and waste management technologies. Pilot projects have the following objectives:

- Address environmental restoration and waste management problems in western states in an efficient, cost-effective manner;
- Speed the development of new environmental restoration technologies and new waste management technologies or new applications of existing technologies; and
- Ensure a foundation for an adequately sized and appropriately trained work force.

Examples of innovative uses of technology that could be applied in demonstration projects include:

- **Remote Sensing.** Use of thermal and magnetic sensors on helicopters to identify soil and groundwater contamination at a fraction of the cost of a walking survey.
- **Cone Penetrometers.** Replacing old-fashioned drilling with cone penetrometers that can punch into the soil and analyze contaminated soil down to 500 feet or more. The penetrometers can analyze ten times more locations for the same cost, for projected savings of $100 million.
- **Air Stripping.** Using in-situ air stripping to clean contaminated groundwater without pumping it to the surface. This process promises to be five times more effective and to cost 40 percent less than traditional technology.

resentatives signed the first cooperative R&D agreement to reduce wastes associated with industrial soldering operations. DOE and EPA initiated discussions on ways to minimize industrial waste through regulations designed to encourage technology development. In cooperation with the industry-based Center for Waste Reduction Technologies, DOE identified R&D requirements to exploit waste reduction opportunities in industry, with an emphasis on chemical production and use.

Waste Management. In August 1992 DOE issued the fourth annual update of its Environmental Restoration

U.S. budget for cleanup of federal facilities.

Federal facility	1989 Actual	1992 Enacted	1993 Enacted	1992-1993 Change Dollar	1992-1993 Change Percent
		million $			%
Department of Energy	1,762	4,407	5,758	+1,351	+31
Department of Defense	1,155	4,172	3,885	-287	-.07
Department of Agriculture	4	38	81	+43	+113
Department of the Interior	41	70	64	-6	-9
Department of Transportation	29	54	54	0	0
NASA, DOJ, and DOC	28	41	59	+18	+44
Total	3,019	7,371	9,901	+1,119	+13

Source: Executive Office of the President, Office of Management and Budget, *Budget of the U.S. Government,* (Washington, DC: U.S. Government Printing Office, 1992).

and Waste Management Five-Year Plan. The objectives are to achieve timely compliance with environmental requirements and to complete cleanup of the 1989 inventory of inactive DOE sites and facilities by the year 2019. DOE is preparing a programmatic environmental impact statement (EIS), also scheduled for completion in 1994, to analyze potential environmental impacts of cleanup and compliance at all of its sites. The DOE budget for environmental restoration and waste management has increased from $2.3 billion in fiscal 1990 to $4.8 billion approved for fiscal 1993.

In 1992 DOE began using environmental restoration management contractors to clean up radioactive and hazardous contamination at its facilities. Remediation contractors manage site investigation, cleanup, decontamination, and decommissioning. DOE awarded an environmental restoration management contract in 1992 for the cleanup of its Fernald, Ohio, site.

Internal Audit Programs. The DOE environmental assessment program identifies strengths, weaknesses, corrective actions, and lessons learned. Environmental audits provide the foundation for efficient and cost-effective management planning.

Nuclear Weapons Complex Reconfiguration. To consolidate and modernize existing facilities, DOE issued a Reconfiguration Study in January 1991. The study included plans for constructing and operating a reorganized complex in compliance with federal, state, and local environmental laws. To comply with the National Environmental Policy Act (NEPA), DOE is preparing an EIS on the reconfiguration plans—to be completed in 1994. The EIS will analyze the environmental consequences of alternative configurations of the nuclear weapons complex.

Permanent Nuclear Waste Repository. As directed by the Nuclear Waste Policy Act (as amended in 1987), DOE is investigating the suitability of Yucca Mountain in southern Nevada for a permanent nuclear waste repository. The site is under consideration for the safe disposal of high-level radioactive waste from commercial nuclear powerplants. Establishment of a permanent repository could help resolve the issue of nuclear waste disposal.

Resolution of a 3-year legal dispute allowed DOE to resume site characterization studies with environmental permits from the State of Nevada. These studies, to be completed before 2001, will determine whether the geology and hydrology of Yucca Mountain will allow for permanent disposal of nuclear wastes. Progress continued on surface testing, development of specialized drilling equipment, and design of an underground exploratory studies facility to ascertain the geological characteristics of the site. In this pioneering effort, DOE, the Nuclear Regulatory Commission, and the congressionally designated Nuclear Waste Technical Review Board worked together to assure that planning accords with scientific review and high standards of nuclear safety.

Monitored Retrievable Storage. To facilitate DOE acceptance of commercial spent nuclear fuel by 1998, the department has planned for a monitored retrievable storage (MRS) facility for temporary above-ground storage of nuclear waste. To date, a designated DOE nuclear waste negotiator has received 20 applications from municipalities and Indian tribes for grants to study the hosting of an MRS site. The department expects to select an MRS site in 1993. In addition, federal and state efforts continue toward the siting of low-level radioactive waste disposal facilities, as mandated by the Low-Level Radioactive Waste Policy Amendments of 1985. Numerous interstate compacts for developing facilities for waste generated within the borders of a state are in effect.

Fisheries and Marine Mammals

Also see Coasts and Oceans, International Issues, Wetlands, and related tables and figures in Part II.

Marine fisheries are an invaluable national asset. Commercial and recreational fishing and associated enterprises contribute $24 billion annually to the U.S. economy. The U.S. Exclusive Economic Zone (EEZ)—at 2 million square miles, the largest of any nation—supports diverse and abundant living marine resources that provide rich economic as well as other quality-of-life benefits.

Conditions and Trends

In 1991 commercial fishermen landed 9.4 billion pounds of fish and shellfish in U.S. waters for a catch worth $3.3 billion at dockside. U.S. exports of edible domestic fishery products totaled a record $3 billion. Alaskan pollack was the leading species in terms of quantity, and shrimp was the most economically valuable species. In the 1991 report, Our Living Oceans: The First Annual Report on the Status of U.S. Living Marine Resources, the National Marine Fisheries Service documented a recent decline in marine species, including fish, shellfish, marine mammals, and sea turtles. The cause is a combination of fishing-related pressures and habitat loss or degradation. Among U.S. fishery stocks, 52.6 percent are fully or over-utilized, and only 13.4 percent are under-utilized. For 34.1 percent of fishery stocks in U.S. waters, too little information is available to make any determination regarding their status.

Low Populations

Populations of many fish with recreational and commercial value are at historically low levels. Populations of New England groundfish, the most valuable component of the region's fishery, are down to 45 percent of their estimated long-term potential. Many Pacific salmon, a symbol of the nation's rich natural heritage, are near extinction. The American Fisheries Society reports that at least 106 stocks of west coast salmonids are extinct and 214 others are at risk. Four stocks are presently listed as threatened or endangered under

the Endangered Species Act (ESA). Present numbers of Atlantic bluefin tuna, which can have a value of $94 per pound or $67,000 for a single large fish, are only 10 percent of what they were 20 years ago.

Declines such as these can have a profound effect on local economies and regional ecosystems. For Massachusetts alone, recent all-time low landings of groundfish translate into annual losses of 88 million pounds or $193 million and 8,000 jobs, when compared to the estimated long-term potential of these species. For all of New England, groundfish losses represent 137 million pounds or $350 million and 14,000 jobs.

The major factors contributing to declines in marine species include overharvesting, bycatch waste, habitat degradation, and, in the case of marine mammals, fishery/marine mammal interactions.

Intensive fishing operations affect more than the abundance of targeted stocks. The functioning and balance of the marine ecosystem can be profoundly impacted. Overharvest of New England groundfish has resulted in steady declines in the abundance of the principal groundfish and flounder species. These declines have been accompanied by steady increases in the numbers of skates and dogfish that inhabit the same ecological niche but have no present commercial value.

Removal of large quantities of historically dominant and commercially valuable groundfish has shifted the relative abundance of different species in the ecosystem. The feasibility of rebuilding groundfish and flounder stocks will depend upon the extent to which these species have been displaced by the now dominant skates and dogfish.

Marine Mammals

Of some 100 species of marine mammals found worldwide, 58 inhabit U.S. waters, and of these, 13 are listed as threatened or endangered under ESA. The status of most marine mammal stocks is uncertain because of a lack of information. The U.S. Marine Mammal Commission, established by the Marine Mammal Protection Act of 1972, administers a research program to fill existing information gaps. The com-

U.S. fisheries.

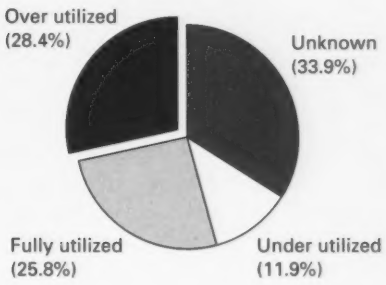
Fishery	Quantity *thousand pounds*	Value *thousand dollars*
Alaskan pollock	2,855,316	241,551
Menhaden	1,977,060	77,694
Salmon	783,285	359,720
Crabs	649,993	414,835
Cods	646,352	196,243
Flounders	404,955	144,789
Shrimp	320,087	512,848
Lobsters	70,433	197,160
Scallops	40,026	162,456

Source: U.S. Department of Commerce, NOAA National Marine Fisheries Service, *Fisheries of the United States,* (Washington, DC: Department of Commerce, NOAA/NMFS, May 1992).

U.S. Department of Commerce, NOAA.

In 1992 commercial fishermen landed fish and shellfish in U.S. waters worth $3.3 billion at dockside.

Status of fishery stocks in U.S. waters.



Note: Based on a total of 232 stocks assessed in 1990.

Source: Part II, Table 86.

mission also reviews federal policies and actions for their impact on marine mammals.

In 1992 the U.S. Marine Mammal Commission reported the following species in most urgent need of protection:

- **Northern Right Whale.** The most endangered marine mammal in U.S. waters, this species is also the world's most endangered large whale. The largest known population, estimated at 350 animals, occurs in coastal waters off the east coasts of Canada and the United States. After being devastated by commercial whaling in the last century, populations now represent 5 percent of estimated pre-commercial exploitation levels. Today, entanglement in fishing gear and collisions with ships may be the principal human-related causes of mortality and injury. In the eastern Pacific Ocean, only seven sightings of right whales have been made in the last 25 years, indicating critically low numbers.
- **Hawaiian Monk Seal.** The most endangered seal in U.S. waters may number as few as 1,500 animals that inhabit the remote northwestern Hawaiian Islands. Interactions with the Hawaiian swordfish industry, which in recent years expanded from 50 to 150 vessels, may be contributing to declines in births and beach counts.
- **West Indian Manatee.** Occurring in the coastal waters and rivers of Florida and Georgia, the long-term survival of this population of 1,800 animals is in doubt. Known deaths between 1988 and 1991 exceeded 550, of which 150 were caused by water craft. Habitat degradation resulting from coastal development may pose the more serious long-term threat to this species.
- **Steller Sea Lion.** Declines in the number of Steller sea lions, throughout their range but particularly in Alaska, led to their being listed in 1990 as threatened under the Endangered Species Act. Fisheries interactions appear to be a contributing factor. Declines of 90 percent have been recorded for major rookeries over the past 30 years, with the great-

Causes of Declines in Marine Species

In waters managed by the United States, recent declines in marine species are attributable to the following causes:

- **Overharvesting.** The removal of fish in such quantities that populations are unable to replace themselves depletes fisheries stocks. Increased domestic fishing operations are a major cause of declines in U.S. fishery stocks. Contributing factors are increased efficiency in fishing technology, overcapitalization of the fishing industry, unlimited access to fisheries, and noncompliance with fishery management regulations.

- **Bycatch Waste.** Inadvertent capture of nontarget and undersized marine species occurs in most fisheries. Fishermen return bycatch to the water but the animals rarely survive. Impacts are significant especially when bycatch would have commercial or recreational value at larger sizes. Shrimp fishermen discard nine pounds of potentially valuable juvenile fish for every pound of shrimp harvested. Fisherman also discard economically valuable species to comply with quotas or other conservation regulations. In New England, 90 percent of yellowtail flounder and cod catches consist of noncommercial sizes lost as potential future catch. Mortality of marine mammals and endangered species such as sea turtles trapped or entangled by fishermen is also a serious bycatch problem.

- **Habitat Degradation.** The loss or degradation of habitat critical to various life stages, particularly reproductive and juvenile stages, of marine life threatens the future viability of U.S. fisheries. Among the

est losses occurring in the last decade. Likely causes of declines include incidental take by trawl fisheries with over 20,000 sea lions taken between 1966 and 1988, commercial exploitation of sea lion prey species (principally pollack), and shooting by fishermen attempting to protect their gear or catch.

- **California Sea Otter.** Numbering around 1,900 animals, the remaining population of sea otters along the central California coast continues at risk and is listed as threatened under ESA. Incidental takes in gillnets, a contributing factor in the decline, were stopped by state actions that prohibit the use of gillnets in sea otter habitat; numbers appear to be increasing.

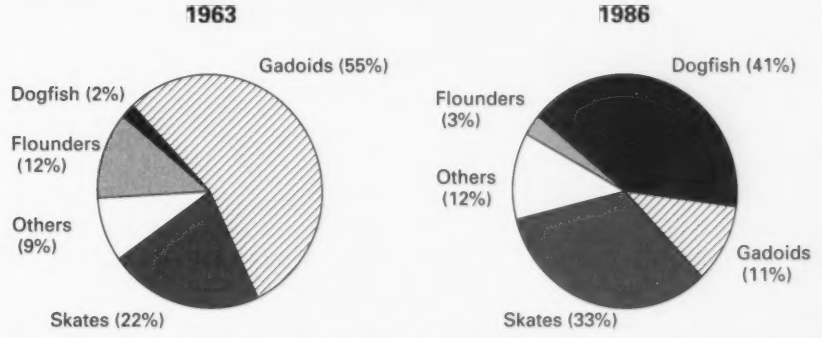
Policies and Programs

The federal agencies with major responsibilities for living marine resources, including anadromous fishes—those that travel between fresh and salt water—are the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS). The U.S. Coast Guard shares enforcement responsibilities at sea.

nation's valuable commercial and recreational species, 75 percent depend on coastal estuaries where impacts of development and pollution may render habitats inadequate. Fully 90 percent of the Gulf coast fishery is critically dependent on estuaries and coastal wetlands. Lack of access to spawning habitat and physical alteration of these sites have profound implications for anadromous salmon stocks. Hydroelectric dams, freshwater diversions for irrigation, and habitat degradation from logging and development have led to the listing of four west coast salmon stocks under the Endangered Species Act; several other stocks face a similar fate.

• **Interactions between Fisheries and Marine Mammals/ Sea Turtles.** Fishing operations can directly disturb marine mammals and sea turtles by harassing, injuring, or killing them. These animals may become trapped or entangled by fishing gear, leading to injury or death as well as to damaged fishing equipment. In 1989 the National Marine Fisheries Service initiated a fishery-wide observer program to collect information on the incidental take of marine mammals in commercial fisheries. Indirect interactions may occur as marine mammals compete for the same fish and shellfish resources as commercial or recreational fishermen. Along the North Atlantic coast, harbor seals are known to remove bait from lobsterpots and eat pen-raised salmon. In the commercial fisheries for pollack and other groundfish in Alaska, fisheries interactions are a contributing factor in the decline of threatened Steller sea lion populations. In addition to being caught in nets and shot by fishermen, the sea lions may be facing a decline in food supplies in the fisheries.

Species shift on Georges Bank off New England.



Note: Gadoids (cod, pollock, haddock, and hake) and flounders are commercially valuable groundfish; skates and dogfish usually are not retained by fishermen.

Source: Adapted with permission from Sissenwine, M.P., and E.B. Cohen, *Resource Productivity and Fisheries Management of the Northeast Shelf Ecosystem*, (Boulder, CO: Westview Press, 1991).

National Marine Fisheries Service

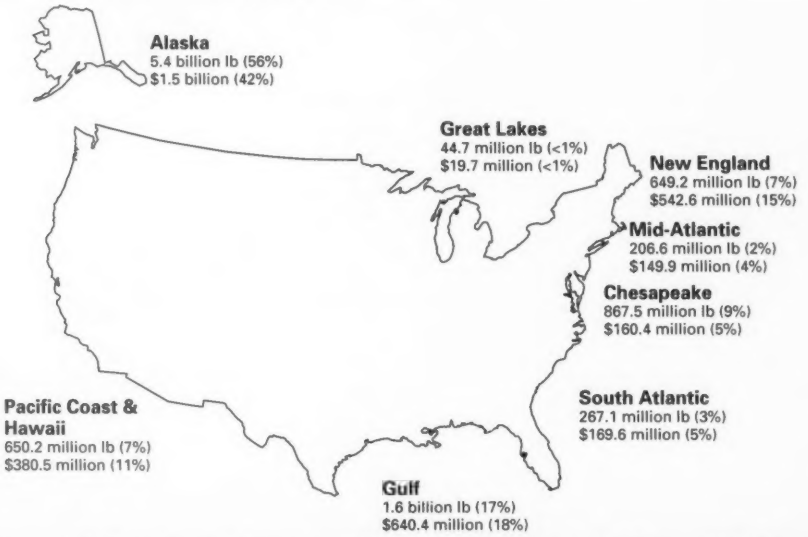
The National Marine Fisheries Service has primary responsibility for stewardship of the nation's living marine resources, including most marine mammals. A part of the National Oceanic and Atmospheric Administration (NOAA) in the Department of Commerce, NMFS oversees the economic welfare of U.S. fisheries as well as the biological health of the marine life and habitat on which these fisheries depend.

Fishery Management Plans. The Magnuson Fishery Conservation and Management Act provides for the conservation and management of all fishery resources within the U.S. Exclusive Economic Zone. The act created eight Regional Fishery Management Councils, whose members represent NMFS, the fishing industry, and affected states. The Fish and Wildlife Service is a nonvoting member of each council, and the Coast Guard advises on enforceability of proposed regulations. The councils are charged with preparing Fishery Management Plans (FMPs) and in 1992 NMFS reported 32 FMPs in place.

Strategic Plan. NMFS has adopted a 5-year strategic plan that reflects a commitment to addressing the problem of declining stocks of marine species. The plan includes the following priority items:

- Rebuild overfished marine fisheries,
- Maintain currently productive fisheries,
- Advance fishery forecasts and ecosystem models,
- Integrate conservation of protected species and fisheries management,
- Improve seafood safety,
- Protect living marine resources habitats,

U.S. commercial catch, by region.



Source: U.S. Department of Commerce, NOAA, *Fisheries of the United States*, 1990. (Silver Spring, MD: DOC/NOAA, May 1991).

- Improve the effectiveness of international fisheries relationships, and
- Reduce impediments to U.S. aquaculture.

Controlling Harvest. Until recently, efforts to control total harvests depended on regulations that decrease overall fishing efficiency: trip limits, size limits, gear restrictions, quotas, and seasonal and area closures. NMFS and the management councils are now considering limiting access to some fisheries. Historically, U.S. fisheries have been managed as open-access resources in which anyone may fish. Under this system, as new fisheries opened and fishing technology improved, fishermen received substantial returns, encouraging more fishermen to enter the fishery. As a result, total harvests approached or exceeded the maximum that many fisheries could support, leading to increased competition among fishermen as each received a smaller share of the declining resource. Fishermen responded by investing in more efficient and more costly technology, which compelled them to seek larger catches to remain economically viable.

Under controlled access systems, eligible fishermen would be guaranteed rights to a predetermined percentage of the total allowable catch, thereby eliminating competition among fishermen for the same resource. Schemes range from a simple moratorium on additional entries to a fishery, to an Individual Transferable Quota (ITQ) system. ITQ allows fishermen to own quotas in a fishery and to trade, sell, or buy them. In 1992 NMFS used controlled access to manage seven different U.S. fisheries and proposes its use in four additional ones.

Habitat Restoration. For Pacific Northwest salmon stocks, habitat degradation rather than overharvesting is the primary issue. The American Fisheries Society has identified 101 stocks at high risk of extinction, 58 at moderate risk, and 54 stocks of special concern. Four are listed under ESA as threatened or endangered. These populations have been most seriously impacted by human activities occurring in and along the rivers in which the fish spawn. Hydropower generation, logging, mining, agriculture, and urban growth block the passage of migrating fish, alter or destroy spawning habitats, and degrade water quality.

Restoring degraded habitats is complicated by the number of parties with a direct stake in such efforts. Maintaining adequate river water quantity and quality for anadromous fish requires coordination at the regional level, with the involvement of federal, state, and local governments, water and power authorities, the timber industry, farmers, developers, private landowners, conservation groups, native American tribes, and recreational and commercial fishermen.

Under the Fish and Wildlife Coordination Act, NMFS comments on federal proposals that could affect U.S. waters essential to living marine resources. These include waters within the EEZ, under state jurisdiction, and throughout the migratory and spawning range of anadromous fish. NMFS provides advice and recommendations to agencies on potential adverse affects of proposed actions on fish habitat.

Protected Species. NMFS manages protection programs for marine mammals, with the exception of polar bears, sea otters, manatees, walrus, and dugongs, which come under the jurisdiction of the Fish and Wildlife Service. All marine mammals receive protection under the Marine Mammal Protection

Controlled access to U.S. fisheries.

Fishery	Location	Access	Status	
			Implemented	*Proposed*
High seas salmon	SE Alaska	Limited entry	1983	
Bottomfish	NW Hawaii	Limited entry	1989	
Surf clam/quahog	Mid-Atlantic	ITQ	1990	
Pelagic longline	Hawaii	Moratorium	1991	
Crustacean	NW Hawaii	Limited entry	1992	
Reef fish	Gulf of Mexico	Moratorium	1992	
Wreckfish	South Atlantic	ITQ		1993
Sablefish/halibut	Alaska	ITQ		1993
Groundfish	North Pacific	License limitation		1993
Groundfish	New England	Moratorium		1993
Groundfish	Alaska	Moratorium		1993

Note: ITQ = Individual Transferable Quota. The National Marine Fisheries Service is monitoring the fisheries that have adopted ITQs to determine if the technique produces significant improvements in fishery resources or economic conditions.

Source: U.S. Department of Commerce, NOAA National Marine Fisheries Service, Silver Spring, MD, 1992.

Act, and some receive further protection under ESA. In addition, the International Whaling Commission (IWC) oversees the management and conservation of large whales, most of which are listed as threatened or endangered. NMFS and the Marine Mammal Commission provide technical advice to the U.S. Commissioner to the IWC, who is also the NOAA administrator. Under the Endangered Species Act, NMFS also manages six species of sea turtles federally listed as threatened or endangered.

International Aspects

The migrations of commercial species such as yellowfin tuna, anadromous Atlantic and Pacific salmon, and Central Bering Sea pollack, have international implications. The conservation and management of such fish and of many marine mammals require high seas fishery management that neither the United States nor any other nation can address alone.

Atlantic Salmon. At the 1992 annual meeting of the North Atlantic Salmon Conservation Organization (NASCO), the United States announced a long-term policy to curtail commercial fisheries that target migrating Atlantic salmon in the high seas. The United States will continue to recognize the legitimate rights of subsistence users and personal-use fisheries and the fact that interceptions of salmon cannot be entirely eliminated. NASCO approved a Protocol to the Convention on Conservation of Salmon in the North Atlantic, calling on other nations to prohibit the fishing of Atlantic salmon stocks beyond national jurisdictions.

Tuna-Dolphin Conservation. The United States also is participating in international efforts to reduce the incidental take of marine mammals in high seas fisheries. In June 1992 the United States and nine other nations adopted a multilateral Dolphin Conservation Program for the Eastern Tropical Pacific Ocean to reduce the incidental mortality

of dolphins in the tuna fishery to the lowest possible level. Over the last three decades, purse-seine tuna fishery operations have killed large numbers of dolphins, where the two species swim together. The agreement establishes a strict schedule to reduce mortality to 5,000 dolphins by 1999, which is one-tenth of 1 percent of the estimated dolphin population in these waters. The conservation program includes a research component to develop techniques for catching yellowfin tuna without harming dolphins and provides detailed procedures to ensure that mortality limits are not exceeded. In October President Bush signed into law the International Dolphin Conservation Act of 1992, amending the Marine Mammal Protection Act to require a dolphin-safe U.S. tuna market by June 1994.

High Seas Driftnet Fishing. This highly destructive fishing technique results in large incidental takes of marine mammals, seabirds, and other forms of life. In keeping with a U.S.-led resolution of the U.N. General Assembly, a moratorium on driftnet fishing went into effect on January 1, 1991.

The High Seas Driftnet Fisheries Enforcement Act of 1992 reflects the U.S. commitment to translate international commitments into domestic action. The Driftnet Act extends the domestic prohibition on high seas driftnet fishing and prohibits the import of all fish and fish products and sport fishing equipment from any country engaged in high seas driftnet fishing beginning January 1, 1993. The law provides for denial of port privileges and navigation in U.S. waters for vessels engaged in the prohibited fishing practice. The act includes measures to establish an international regime for the

U.S. Department of Commerce, NOAA.

The U.S. Marine Mammal Commission administers a research program on species such as this humpback whale.

management of the high seas fishery in the Central Bering Sea.

U.N. Conference on Environment and Development. UNCED addressed high seas fishing issues in *Agenda 21*, the document intended to provide guidance for setting a global course to sustainable development. In the *Agenda 21* chapter on oceans, the United States supported language to ensure that populations of marine species are maintained at healthy levels, that populations of marine mammals are protected, and that fishing gear minimizes the incidental catch of nontarget species. Following UNCED, the U.N. General Assembly adopted a resolution endorsing an intergovernmental conference on high seas fishing issues to be held in late 1993. The United States is cooperating with the U.N Food and Agriculture Organization (FAO) and the Organization of Economic Cooperation and Development (OECD) to address conservation as well as trade questions pertaining to high seas fishing.

Whaling Moratorium. The United States has supported an international moratorium on commercial whaling since inception of the ban in 1985 under the auspices of the International Whaling Commission (IWC). Because several nations other than the United States desire an easing of the ban, the commission, at its annual meeting in 1992, moved toward adopting a sustainable, scientifically based procedure for calculating whale quotas. IWC parties agreed that until this procedure is adopted and in force, the moratorium on commercial whaling should continue, a stance supported by the United States.

Sea Turtles. Commercial shrimp-fishing operations in the Caribbean region often result in the incidental capture and drowning of threatened and endangered species of sea turtles. In response, during the past three years, the United States has implemented legislation prohibiting Caribbean shrimp imports unless those countries adopt specific measures to reduce incidental capture of sea turtles.

For example, shrimp fishermen in the United States are required by law to equip their nets with a piece of gear known as a "turtle excluder device" (TED), which reduces the incidental capture of sea turtles by more than 97 percent. TED usage is considered essential for the survival of endangered sea turtle populations in the wider Caribbean. Caribbean nations that do not undertake comparable steps to install TEDs and reduce incidental turtle takes may face shrimp import embargoes. The United States offers technical assistance to help affected countries incorporate TED technology into their shrimp fleets.

Forestry

Also see Biodiversity, International Issues, Public Lands, and related tables and figures in Part II.

Forests are a source of ecological services and economic goods—from soil and watershed protection to timber and fuelwood to carbon sequestration, wildlife habitat, and recreation. The ecology and economics of the forest cannot be separated, since forest values are at once local, national, and global in scope. In 1992, in the midst of heightened domestic and international debate about forests, the U.S. government adopted a philosophy of ecosystem management for federal lands and led the way in calling for global forest conservation.

Conditions and Trends

The call to conserve and sustain forests is urgent because many types are under stress around the world. Forest conversions on private lands are a trend both at home and abroad.

U.S. Forests

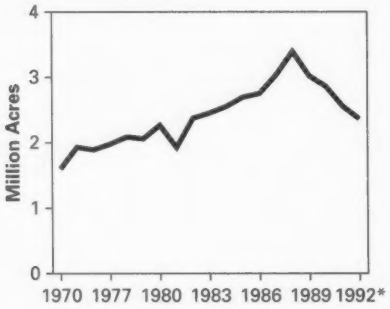
Forests occupy about a third of the nation's land area, with forest types varying from sparse scrub forests of the arid interior West to the highly productive forests of the Pacific Coast and the South. The majority of U.S. forests, about 525 million acres, are in state and private ownership, with the balance in federal forests. Most eastern forests are in state or private ownership, and western forests are divided between the federal government and other owners.

Americans reforested 2.9 million acres of public and private forestland in fiscal 1991, near record highs, and a comparable acreage was regenerated naturally. On managed acres, forest growth exceeded harvests by 37 percent, up threefold over the 1920s, but the nation continues to lose half a million acres of private forestlands per year because of conversions to such uses as urban expansion and agricultural crops. At this rate, total U.S. forests could decrease from 731 million acres in 1992 to 703 million acres in 2040, a 4-percent decline.

Reforestation can improve damaged ecosystems and help protect watersheds, soil, and crops. The number of

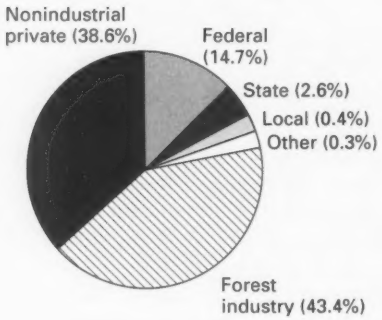
U.S. tree planting.

Acres planted and seeded.



*Preliminary estimate.

Planting and seeding by ownership.



Source: USDA Forest Service, State and Private Forestry, Cooperative Forestry, *Tree Planting in the United States—1990,* (Washington, DC: USDA Forest Service, March 1991).

trees planted in 1991 was the seventh highest of any year in U.S. history. Of acres planted in trees, 82 percent were on private lands, and of these, 39 percent had nonindustrial private owners.

U.S. forests, on the whole, are healthy, but problems arise, especially on managed forests, in response to stresses such as insects and drought. In some managed forests, past harvesting practices and fire suppression have resulted in stands poorly adapted to the site, prone to insect and disease problems, and stressed by drought. Potential for catastrophic wildfire is high because of the accumulation of dead and dying vegetation.

Throughout the nation, forest pests are causing serious damage. The European gypsy moth defoliated 4 million acres in 14 states in 1991, affecting the health of oaks and associated species. The southern pine beetle reached epidemic levels in 7 states and threatened timber, wilderness values, and habitat for the endangered red-cockaded woodpecker. The Douglas-fir tussock moth and western spruce budworm were at elevated levels in the Pacific Northwest. Root diseases and dwarf mistletoe in the West, fusiform rust in the South, and dogwood anthracnose in the East and South are causing concern.

International Forestry

According to a 1990 estimate by the U.N. Food and Agriculture Organization, tropical forests are disappearing at a rate of 17 million hectares (42 million acres) a year. Responding to population pressures and widespread poverty, many nations provide incentives for forest conversion to farmland and pasture. Other causes include destructive logging practices, overharvesting of commercial forests, subsidized timber sales, and large-scale development projects such as hydropower and mining.

Temperate and boreal forests, although expanding in some areas, are substantially degraded in other areas because of factors affecting forest health that include air pollution, inefficient harvesting, and lack of reforestation. In some parts of Eastern Europe, forest dieback caused primarily by air pollution is as high as 50 percent. In

USDA Forest Service.

Recreation is one of the fastest growing uses of the National Forest System.

1992, however, the general condition of European forests showed improvement over recent years.

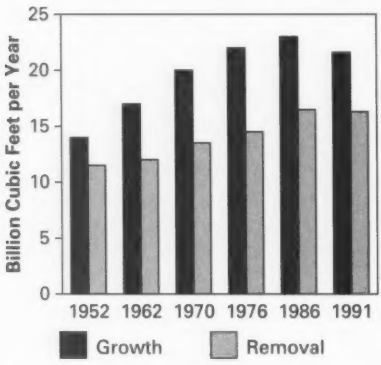
Policies and Programs

Federal forestry initiatives, both domestic and international, are conducted primarily by the Forest Service in the Department of Agriculture, the Department of the Interior (DOI), the Department of Defense (DOD), and the U.S. Agency for International Development (USAID).

U.S. Forestry

In 1992 the DOI Bureau of Land Management and the USDA Forest Service announced complementary forestry initiatives based on ecosystem management.

U.S. timber growth and removals.



Source: See Part II, Table 58.

National Forests. In response to new scientific information and mounting public opposition, the Forest Service announced in June 1992 that it will phase out clearcutting as a standard practice on national forests. As part of its new ecosystem management philosophy, the agency will make greater use of other harvesting methods to provide more visually pleasing and ecologically sensitive forest management. The Forest Service will allow clearcutting only in situations where it best accomplishes specific objectives of the forest plan.

- **Reforestation.** In 1991 the national forests set a reforestation record with 503,000 acres reforested by planting, seeding, or natural regeneration. The Forest Service planted over 50 species of trees, many of genetically improved stock, to maintain vegetation diversity. Sites included timber sale harvest areas and areas devastated by natural catastrophes such as fires, insects and disease, and windstorms.
- **Harvesting.** National forests contain 47 percent of the nation's standing softwood sawtimber inventory, but, in addition to timber, these forests possess wilderness, wildlife, watershed, and recreation values. Recent Forest Service planning documents identified recreation as the fastest growing use of national forests in the 1990s. The Forest Service conducts harvesting, where permitted, in an environmentally sensitive manner to maintain long-term health and productivity. In fiscal 1991 national forests contributed 19 percent of the nation's total softwood sawtimber volume used for lumber, up from 13 percent in fiscal 1986.

In fiscal 1991 the Forest Service sold 6.4 billion board feet of timber, down a billion board feet from recent years. The decrease in volume reflected, in part, management concerns relating to biodiversity and the maintenance of old-growth forests and other habitat for endangered species. As of August 31, 1992, with 80 percent of the year's data in, national forest timber harvests had produced gross revenues to the national treasury of $985 million and net revenues of $326.7 million.

- **Forest Fire Behavior.** To combat catastrophic forest fires, the Intermountain Fire Science Laboratory in Missoula, Montana, developed a prediction system for extreme fire behavior that resulted in more effective use of fire suppression to protect human life, property, and natural resources. The lab is a unit of the Intermountain Forest Experiment Station in Ogden, Utah.

Interior Forestlands. DOI manages 125 million acres of forestland, with objectives that reflect the different missions of the National Park Service (NPS), the Fish and Wildlife Service (FWS), the Bureau of Land Management (BLM), and the Bureau of Indian Affairs (BIA).

• **National Park Service.** National parks contain 37 million acres of forestland, managed solely for preservation with no commercial timber operations.

• **Fish and Wildlife Service.** National wildlife refuges contain 18 million acres of forestland managed for a diversity of indigenous wildlife populations. FWS allows limited commercial forestry operations, consistent with habitat objectives.

• **Bureau of Land Management.** BLM manages 48 million acres of forestland in 12 western states and Alaska. The BLM Total Forest Management policy, adopted in June 1992, provides an ecosystem approach to timber harvesting. In addition to timber, TFM objectives include water quality, soil conservation, fish and wildlife habitat, old growth, aesthetics, and recreation. Clearcutting will no longer be the management tool of choice, except where it is the most environmentally effective method to achieve specific management objectives, such as rehabilitating lands affected by fires, windstorms, insects and disease, and other natural disasters. TFM is reflected in the draft 10-year Resource Management Plan for western Oregon that BLM issued in August 1992 and in guidelines for managing BLM forestlands in western states and Alaska.

In 1991 the sale of BLM forest products, including lumber, fuelwood, ferns, and mushrooms, brought $145 million into the national treasury. Timber harvesting is restricted to about half of BLM forestlands because of wilderness designation, special study areas, sites that can be easily damaged, and sites with special wildlife and recreational values. In 1992 BLM planted 35,000 acres with 17.5 million seedlings and initiated an inventory of its forestlands in Alaska, in response to interest in expanding timber harvesting.

• **Bureau of Indian Affairs.** BIA manages 16 million acres of forestland in 23 states for the use and benefit of Native American owners. The objective is to perpetuate economic forest products and employment opportunities as well as ecological, environmental, and biological forest values. In November 1990 President Bush signed the National Indian Forest Resources Act, culminating a joint effort by Indian tribes, the Intertribal Timber Council, the BIA Division of Forestry, and the Congress to develop a comprehensive statute for managing tribal forests.

America the Beautiful Forestry. To help meet the President's goal to plant and maintain an additional billion trees per year in urban and rural areas in this decade, the Forest Service and state foresters have established a cost-sharing Stewardship Incentive Program with the following components:

- Tree planting,
- Stabilizing eroded lands,
- Protecting riparian areas and wetlands,
- Improving wildlife and fisheries habitat,
- Enhancing forest recreation, and
- Establishing and renovating windbreaks and hedgerows.

In 1991 the program helped landowners develop 13,596 forest stewardship plans to enhance the management of natural resources on 1.4 million acres of private forestland. In 1992 an additional 20,239 plans improved man-

agement of another 2.5 million acres. All 50 states have formed State Forest Stewardship Coordinating Committees to assist state foresters with the program. The USDA Forest Service, Soil Conservation Service, Extension Service, and Agricultural Stabilization and Conservation Service work with state foresters to provide technical assistance.

Forest Legacy. The Forestry Title of the 1990 Farm Bill directed the Secretary of Agriculture to establish a Forest Legacy Program to identify environmentally valuable forestlands threatened by conversion to nonforest uses such as residential and commercial development and to protect them through voluntary conservation easements. The program protects both traditional uses of private lands and public forest values for future generations. In 1992 the Forest Service finalized guidelines to implement the program in five lead states—New York, New Hampshire, Vermont, Maine, and Washington. The fiscal 1992 appropriations bill added Massachusetts.

Forest Health. In response to a serious loss of trees from insects and disease, federal agencies have accelerated forest health programs.

- **Forest Health Monitoring Program.** In 1992 state forest resource agencies worked with the Forest Service, BLM, and EPA to monitor long-term trends in health and productivity of U.S. forest ecosystems. A monitoring network now includes the New England states and parts of the mid-Atlantic, Southeast, and West. In 1992 these efforts focused on the condition of sugar maple trees through the U.S.-Canada North American Maple Project. When fully implemented, the Forest Health Monitoring Program will provide regional and national data on the health of all U.S. forestlands.
- **Accelerated Treatments.** In 1992 in response to tree mortality in the Blue Mountains of Oregon and Washington, the Forest Service directed $51.5 million to national forests in the area to salvage dead and dying trees, prevent and suppress insect and disease infestations, and conduct research on pest control techniques. Similar initiatives are planned for eastern Washington, California, and the Southeast.
- **Imitating Nature.** BLM is accelerating the harvest of dead and dying trees and, with the USDA Forest Service, is evaluating tree density control by imitating natural processes of forest development, such as thinning, planting diverse species mixes, and using fire.
- **Asian Gypsy Moth.** This forest pest, native to eastern Russia, was detected in Oregon and Washington in 1991. In April and May of 1992 the USDA Animal and Plant Health Inspection Service, the Forest Service, and the states of Oregon and Washington cooperated on eradication treatments on 124,000 acres, using a microorganism that kills the moth. A gypsy moth trapping network will monitor the success of the biocontrol treatments.
- **European Gypsy Moth.** Using biotechnology, scientists at the Center for Biological Control of Northeastern Forest Insects and Diseases in Hamden, Connecticut, developed a new strain of virus that kills the European gypsy moth. Simplified procedures for commercial production will allow its widespread use as an economical, environmentally benign control agent.

• **Pest Risk of Imports.** In response to a proposal by the timber industry to import logs from Russia, New Zealand, and Chile, the Forest Service assessed larch logs from Russia and identified several serious pest risks. The Animal and Plant Health Inspection Service used the assessments to formulate measures for excluding exotic pests from U.S. forests.

Hurricane Reparations. In the aftermath of two major hurricanes in 1992, the Forest Service supplied tree-planting funds to Florida, Louisiana, and Hawaii. The agency also neared completion of reforestation efforts in South Carolina following Hurricane Hugo in 1990.

Pacific Yew and Cancer Treatment. The National Cancer Institute (NCI) describes taxol, a substance found concentrated in the bark of Pacific yew trees, as the most promising anti-cancer agent of the last decade. However, large amounts of yew bark—up to 60 pounds from three mature trees—are needed to produce enough taxol for the treatment of one patient. Another complicating factor is the habitat of the yew—primarily federal old-growth forests slated for increased preservation in Oregon, Washington, Idaho, and California. Taxol may be approved for commercial use as early as 1993, when the demand likely will increase.

Federal agencies are cooperating to supply the taxol needed for research and treatment in an environmentally responsible manner. Recent actions included the following:

• The Forest Service implemented a cooperative agreement with the Bristol-Myers Squibb Company to ensure that bark is supplied for research, that the Pacific yew resource is managed to ensure sustainability, and that local people are involved in bark harvest;

• The Food and Drug Administration, BLM, and the Forest Service collaborated on preparation of an environmental impact statement covering a

National Wildlife Federation.

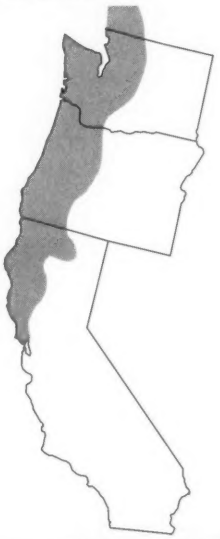
The endangered northern spotted owl depends on old-growth forests in the Pacific Northwest.

Old-growth Forests and the Northern Spotted Owl

In 1992 efforts to protect old-growth forests in the Pacific Northwest by reducing federal timber harvests continued to raise concern over economic impacts on small, timber-dependent communities. These forests are the habitat of the endangered northern spotted owl, and the majority of old growth remaining in the region is located on federal lands managed by the USDA Forest Service and the DOI Bureau of Land Management.

Conservation Strategy. In January 1992 the Forest Service filed a final environmental impact statement (EIS) on managing old-growth habitat, and in March the Department of Agriculture adopted the Forest Service Conservation Strategy for the northern spotted owl, prepared pursuant to an EIS. The strategy combines old-growth preservation with methods to sustain or create old-growth characteristics for the future. Implementation of the strategy and timber sales in suitable spotted owl habitat have been stayed by federal courts pending the outcome of litigation.

Range of the Northern Spotted Owl



Source: Interagency Scientific Committee to Address the Conservation of the Northern Spotted Owl, *A Conservation Strategy for the Northern Spotted Owl*, Committee Report, (Washington, DC: Departments of Agriculture and the Interior, 1990.)

Endangered Species Committee. In response to a petition from BLM, the Secretary of the Interior convened the Endangered Species Committee to consider 44 BLM timber sales in Oregon that the Fish and Wildlife Service (FWS) determined would jeopardize the existence of the northern spotted owl. As required by the Endangered Species Act (ESA), the committee consists of the secretaries of the Interior, Army, and Agriculture, administrators of the National Oceanic and Atmospheric Administration and Environmental Protection Agency, chairman of the Council on Economic Advisors, and a representative from any affected state, in this case, Oregon.

The Endangered Species Act allows the committee to exempt actions such as timber sales from restrictions of the act, if such actions meet the following criteria: absence of reasonable and prudent alternative courses of action; regional or national significance, defined on a

case-by-case basis; benefits that outweigh those of alternatives; and identified mitigation measures.

In May 1992 the committee exempted 13 of 44 proposed BLM sales, denied exemptions for the other 31, and required, as mitigation for the exempted sales, that BLM implement a recovery plan for the northern spotted owl as expeditiously as possible to serve as the basis for the next BLM 10-year plan. The 13 sales encompass 1,742 acres of forestland with a timber volume of 88 million board feet. Court action has blocked the 13 exempted sales.

Recovery Plan for the Northern Spotted Owl. In January 1992 FWS designated critical habitat for the northern spotted owl, and in May 1992 the secretary of the Interior issued a draft recovery plan for the owl, as required by ESA. The recovery plan includes the following elements:

- A network of 196 Designated Conservation Areas (DCAs) on federal lands to be managed for owl habitat, encompassing 7.5 million acres, 2.1 million acres of which are within national parks and wilderness areas.
- Guidelines for forest management and other activities on DCAs, prohibiting commercial timber harvest in owl habitat.
- Management recommendations for federal lands outside DCAs, initially adding 410,000 protected acres.
- A set of standards for judging when the northern spotted owl has reached recovery and thus no longer needs ESA protection.
- Recommendations for contributions from nonfederal forestlands to support northern spotted owl populations.
- A monitoring and research program to seek information on the owl and its habitat and to develop and test techniques for creating and maintaining owl habitat while allowing forest management.
- Mechanisms to implement the recovery plan, providing oversight and coordination.

Alternative Plan. At the same time that DOI prepared the draft recovery plan, it also prepared an alternative plan to protect owl habitat at a lower cost to the region's economy. The alternative plan would create a network of 75 DCAs encompassing 2.8 million acres of nonreserved lands and 1.5 million acres of reserved lands. Habitat in other parts of the range would not be managed with owl needs as the primary consideration. Implementation of the alternative plan would require congressional approval, since it does not meet all the goals of the Endangered Species Act.

Resource Management Plans. Court actions also have halted BLM timber sales in western Oregon pending completion of Resource Management Plans (RMPs) for six districts. In 1992 the Bureau prepared draft RMPs and draft environmental impact statements. Based on an ecosystem approach to management, the plans will determine old-growth timber harvests for the next decade.

proposed 5-year program to collect Pacific yew bark for research, clinical trials, and treatment.

• BLM and the Forest Service each issued 1992 draft guidelines on managing the Pacific yew to help ensure a sustainable supply of yew for the medical community and for the continued existence of Pacific yew in the forest ecosystem.

• The Forest Service also took the following initiatives:

– Inventoried national forests most likely to contain Pacific yew;

– Initiated research on the silviculture, ecology, and management of Pacific yew;

– Worked with Congressional committees for passage of the Pacific Yew Act of 1992, which authorizes the Forest Service to negotiate yew-bark sales and use receipts to pay for the program.

– Collected 825,000 pounds of bark in 1991 on 10 national forests in Idaho, Montana, Oregon, and Washington and, as of August 1992, collected 646,000 pounds of bark for continued clinical trials.

International Forestry

In 1992 public and private efforts were underway to promote sustainable forest management abroad, especially in developing countries. Examples follow.

USDA Forest Service. The 1990 Farm Bill authorized the secretary of Agriculture to create, within the Forest Service, an Office of International Forestry led by a deputy chief. Estab-

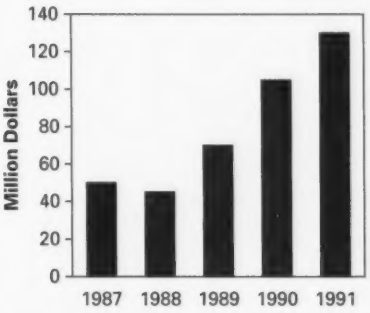
Forests for the Future

In preparation for the June 1992 U.N. Conference on Environment and Development (UNCED), President Bush launched the Forests for the Future initiative, calling on the donor community to double world assistance for forests to $2.7 billion. He pledged to increase annual U.S. bilateral forest assistance by $150 million and endorsed a pledge of $20 million to the Brazil Rainforest Pilot Program, an additional $2 million for the International Tropical Timber Organization, and reform of the World Bank forestry policy.

At UNCED, President Bush and 130 other heads of state signed a "non-legally binding authoritative statement of principles for a global consensus on the management, conservation, and sustainable development of all types of forests." President Bush first called for a world forestry agreement at the 1990 G-7 summit in Houston, and the United States and other G-7 countries support the UNCED statement of principles as a first step toward a binding forest convention.

At the Rio Conference, participating nations accepted the report, *Conservation and Development of Forests*, by the UNCED Secretary General on conditions of world forests and threats facing them. They also adopted *Agenda 21*, which includes a common approach for countries to use in integrating national actions and international cooperation with forest conservation and sustainable development.

U.S. international assistance for forestry.



Source: Executive Office of the President, *United States of America National Report,* (Washington, DC: U.S. Government Printing Office, June 1992).

lished in June 1991, the Office of International Forestry coordinates programs in the following areas:

- Tropical forestry technical assistance and training,
- Cooperative work with USAID,
- International scientific and technical exchanges,
- Cooperative research with other countries,
- Support to international organizations responsible for global forestry issues, and
- Operation of the Institute of Tropical Forestry in Puerto Rico as an international institution.

The Office of International Forestry administers the following programs:

- **Forestry Support Program.** In 1992 the Forest Service provided forestry technical assistance and trainers in support of 18 USAID programs, including projects in Indonesia, Costa Rica, Nicaragua, Ghana, Uganda, Panama, Haiti, Guinea, and the Sahel.
- **Tropical Forestry Program.** The Forest Service held workshops in 1992 on agroforestry and remote sensing in East Africa, Latin America, and Panama. Forest Service staff provided training and technical advice to Brazil on wildfire suppression and helped establish "Twinning Relationships" between U.S. national forests and forestry organizations in Mali, West Africa, and Costa Rica.
- **Disaster Assistance Support Program.** The Forest Service provides emergency response, preparedness, prevention, and mitigation assistance for global disasters, including catastrophic forest fires.
- **Cooperative Research.** In 1992 Forest Service scientists participated in 11 cooperative research programs in four countries—Pakistan, Poland, the Republic of China (Taiwan), and Yugoslavia. In addition, they provided forest pest management assistance to Africa and China.

Forestry Carbon Dioxide Offset Schemes. Several private U.S. firms are experimenting with forestry projects in developing countries to offset carbon dioxide emissions from U.S. operations. For example, in August 1992 New England Power Company and Innoprise, a major Malaysian forest products company, announced a 3-year pilot project to make logging practices less damaging to the rainforest in Malaysia. The project is part of a previously announced plan by the utility to lower or offset its greenhouse gas emissions 45 percent by the year 2000. By reducing the number of surrounding trees destroyed during harvesting and by enhancing forest regeneration, the foresters hope to sustain trees capable of removing 300,000-600,000 tons of carbon dioxide from the atmosphere over the life of the project—trees that otherwise would have

been removed from land that would not have been reforested. The project will be monitored by the Rain Forest Alliance, a New York-based environmental group. If successful, reduced impact logging techniques could be applied to tropical hardwood rain forests in the Philippines, Indonesia, New Guinea, and other developing nations.

Hazardous and Solid Wastes

Also see Federal Facilities Management, Pollution Prevention, Technology, and related tables and figures in Part II.

The United States has some of the world's most stringent laws regulating the handling and disposal of hazardous and solid wastes. These laws have spawned an array of complex regulations, some of which place a heavy burden on those regulated, especially small businesses and communities. In 1992 President Bush issued a directive to federal agencies to review and revise existing regulatory programs, and Congress began considering reforms that would achieve environmental protection with less burdensome regulatory control.

Conditions and Trends

Until 1976, when Congress passed the Resource Conservation and Recovery Act (RCRA), federal agencies had little authority to regulate hazardous and solid wastes. RCRA instituted a cradle-to-grave management system for hazardous wastes and developed disposal criteria for solid wastes, including municipal solid wastes. Over the past decade, RCRA, with its provisions for state regulation, has been joined by other federal environmental laws that authorize the Environmental Protection Agency (EPA) and the states to undertake programs to prevent pollution, manage hazardous wastes, clean up hazardous waste sites, ensure the safety of underground storage tanks containing petroleum or hazardous substances, and address the growing volume of municipal solid waste to ensure its safe management.

By current EPA estimates, the United States spends $35 billion a year on the following activities:

- Managing and disposing of hazardous waste and cleaning up contamination from such wastes at hazardous waste management facilities;
- Collecting, managing, and disposing of municipal and other solid wastes; and
- Managing the underground storage tank improvement and cleanup program.

EPA estimates that these expenditures will rise significantly by the year 2000—faster than any other category of environmental regulation. For example, with no changes in current law, the costs of the Superfund hazardous waste site cleanup program could rise from approximately $2.5 billion in 1992 to $7 billion in the year 2000.

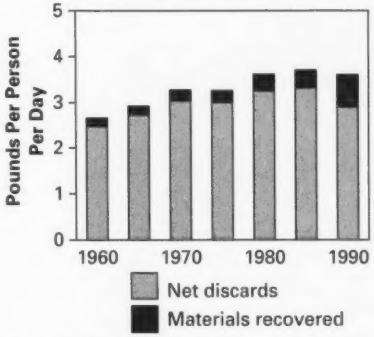
In 1992, acting upon the Presidential directive to review and revise existing programs, the EPA Office of Solid Waste and Emergency Response (OSWER) proposed a package of reforms. To avoid regulatory relief at the expense of environmental protection, OSWER proposed the following reforms that would balance regulatory control with environmental risk to protect human health, the environment, and the economy:

- RCRA Reform Initiative. Regulatory reforms would reduce cost to industry by tailoring controls to risk and by removing certain administrative requirements;
- Superfund Revitalization. Reforms would improve the effectiveness, efficiency, and equity of the Superfund program, administered by EPA under the 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) and the 1986 Superfund Amendments and Reauthorization Act (SARA);
- OSWER Reforms. The EPA Office of Solid Waste and Emergency Response would improve its responsiveness.

Municipal Solid Waste

Regulatory reforms would promote cost-saving pollution prevention in such areas as municipal solid waste. EPA estimates that in 1990 Americans produced approximately 196 million tons of trash (4.3 pounds per person per day), double the amount produced in 1960. In the absence of additional actions to reduce trash, EPA estimates that the amount generated in the United States could reach 222 million tons (4.5 pounds per person per day) by the year 2000.

Municipal solid waste disposal and recovery, per capita.



Source: Part II, Table 90.

Meanwhile, the number of landfills open to receive wastes declined from 20,000 in 1978 to 6,000 in 1986 as many landfills and open dumps reached capacity or were closed because of inappropriate design or operation. Many of the remaining landfills are expected to reach their capacity during the coming decade. Public opposition to the siting of new waste management facilities, expressed by "not in my backyard" sentiments, makes it difficult to site new landfills, even though they are safer.

The national trend is to reduce the amount and toxicity of wastes through such approaches as source reduction and recycling. EPA estimates that the rate at which materials in the municipal

solid waste stream were diverted for recycling or composting rose from 7 percent in 1960 (6 million tons) to 17 percent (33 million tons) in 1990. Between 1985 and 1990 this amount doubled.

Interstate Transport of Solid Waste

In recent years, transport of municipal and other solid wastes across state boundaries became a contentious issue as half the states enacted new restrictions or requirements on imports of out-of-state solid waste. The commerce clause of the U.S. Constitution, which prohibits states from restricting interstate commerce without the consent of the Congress, has been the basis for court challenges to laws impeding the interstate transport of wastes. Recent sessions of the U.S. Congress have considered legislation without resolving the issue.

Transboundary Movements of Hazardous Wastes

Regulating exports of hazardous and other wastes is an emerging trend in the international community. In 1990 the United States signed the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. In August 1992 the Senate gave consent to the U.S. ratification of the Convention, and Congress must now enact enabling legislation. Proposed federal legislation to implement the Basel Convention would prohibit the export and import of hazardous and municipal wastes and residues from the incineration of municipal wastes, except in cases where the United States has a bilateral agreement with another country ensuring that wastes will be handled in an environmentally sound manner.

Policies and Programs

As the volume of hazardous and solid waste increased in conjunction with national growth, government agencies—federal, state, and local—have responded with a number of programs, many in partnership with private-sector groups.

Hazardous Waste

U.S. environmental laws regulate the generation, transport, storage, treatment, and disposal of hazardous wastes. A summary follows on relevant provisions of RCRA; the Hazardous and Solid Waste Amendments of 1984 (RCRA amendments); CERCLA; SARA, including the Emergency Planning and Community Right-to-Know Act; the Clean Air Act Amendments of 1990; and the Hazardous Materials Transportation Uniform Safety Act of 1990.

RCRA and the RCRA Amendments. RCRA and the RCRA amendments regulate the generation, transportation, storage, treatment, and final disposal of hazardous and solid wastes. RCRA regulates solid wastes produced by 200,000 generators. Today many of these wastes are banned from land disposal unless treated to meet EPA standards, which require best available treatment technology—chemical or biological treatment or incineration—to reduce toxicity and stabilize residues.

- **Land Disposal Restriction.** The EPA Land Disposal Restriction Program has resulted in 42.5 million tons of hazardous wastes being treated each year prior to final disposal. Of this total, provisions of the Safe Drinking Water Act regulate 34 million tons of treated wastes pumped into the ground in underground injection wells. The remaining 8.5 mil-

What Is a Hazardous Waste?

According to the Resource Conservation and Recovery Act of 1976 (RCRA) and the Hazardous and Solid Waste Amendments of 1984 (RCRA amendments), a hazardous waste may be "garbage, refuse, or sludge or any other waste material" that exhibits one or more of the following characteristics:

S.C. Delaney, EPA.

- Ignitability,
- Corrosivity,
- Reactivity (unstable under normal conditions and capable of posing dangers),
- Toxicity (harmful or fatal when ingested or absorbed).

Improperly handled, hazardous wastes can contaminate surface waters and groundwater, release toxic vapors into the air, or cause other dangerous situations, such as explosions.

lion tons are disposed of in or just below the land surface in RCRA-regulated landfills, surface impoundments, and land application units.

• **Corrective Actions.** EPA can require corrective actions to address all releases of hazardous waste or hazardous constituents from any facility requiring a RCRA hazardous waste permit. Of 4,600 hazardous waste facilities subject to corrective actions, EPA estimates 3,600 will require some form of cleanup. To date, EPA and states authorized to run the corrective action program have conducted 3,000 initial assessments. Of this total, 800 facilities are pursuing corrective action under consent orders or permit requirements, and 135 facilities are conducting cleanup activities.

• **RCRA Reform.** In 1992 EPA began a major RCRA Reform Initiative that could save businesses and communities billions of dollars annually. RCRA reform has the following objectives:

– Redirect RCRA towards higher risk wastes and cleanup activities;
– Expedite the pace of corrective action cleanups at RCRA facilities;
– Tailor management standards to environmental risks posed by waste management; and
– Streamline the RCRA permit system to facilitate cleanups and hazardous waste recycling and also to address closed facilities.

• **Underground Storage Tanks.** Chemicals that escape from underground tanks containing petroleum or other hazardous substances can con-

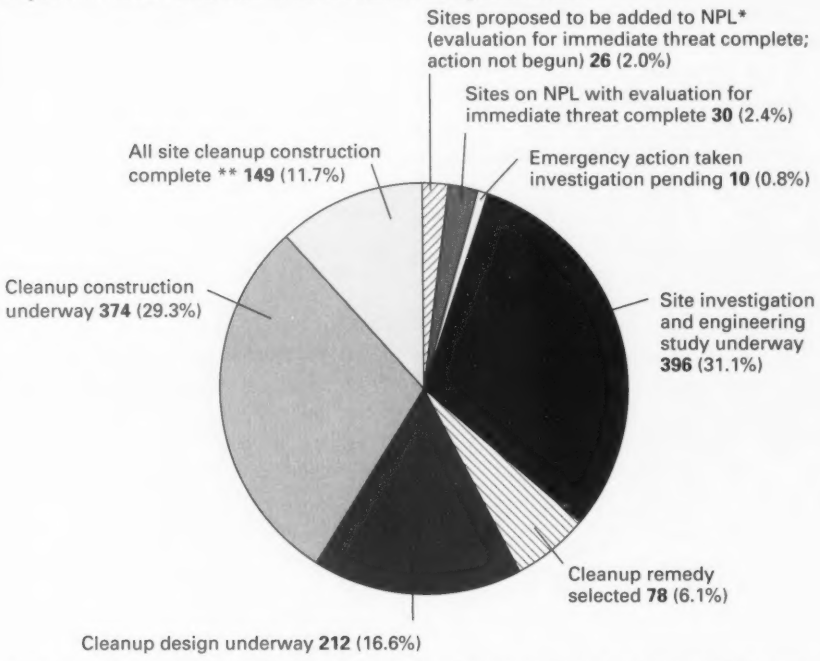
taminate drinking water supplies. Fumes from these tanks can pose health hazards, including fires and explosions. The RCRA amendments require tank registration, leak detection, leak prevention, and corrective action. From 1990 through August 1992, states and private parties confirmed 167,000 releases, initiated 114,000 cleanups, and completed 45,000 cleanups. When a responsible party for a tank cannot be found to oversee corrective action, EPA authorizes 49 states, 5 U.S. territories, and the District of Columbia to use the Leaking Underground Storage Tank Trust Fund for cleanups. As of June 1992 the Trust Fund had collected $810 million for cleanup actions.

Superfund. CERCLA created the Superfund program to respond to a release or threatened release of hazardous substances, pollutants, and contaminants stemming from accidents or uncontrolled hazardous waste sites. Under the law, those responsible for the contamination are required to conduct the cleanup. Where enforcement is not successful, the federal government can clean up a site using the CERCLA Trust Fund (Superfund), which is supported by excise taxes on feedstock chemicals and petroleum and by a more broadly based corporate environmental tax. If the Superfund program conducts the cleanup, the government can take court action against responsible parties to recover costs with, in some cases, as much as treble damages.

To accelerate responses, EPA seeks to have responsible parties begin the remedial design before entry of a consent decree. In fiscal 1991 parties liable for contamination at nonfederal Superfund sites agreed to perform a record 63 percent of new cleanup work; in 1992 that figure rose to a record 72 percent. The total value of responsible party commitments to conduct site study and cleanups at Superfund sites has exceeded $1 billion for each of the past three years. Since Superfund was created in 1980, EPA has obtained $7 billion in site work commitments from responsible parties, with three-quarters of this amount obtained since 1988. Examples of recent Superfund accomplishments follow.

- **Site Evaluations.** Through November 1992 EPA had identified 37,592 potentially hazardous waste sites across the nation. Of these, 93 percent have undergone a preliminary assessment to determine the need for further action.
- **National Priorities List.** EPA maintains the Superfund National Priorities List (NPL), which identifies the nation's most seriously contaminated hazardous waste sites eligible for permanent Superfund cleanup. As of mid-November 1992 a total of 1,252 sites had been listed, on which work was underway at 95 percent and cleanup construction was in process or complete at 41 percent. In fiscal 1992 permanent cleanup construction was completed at 86 sites—a total equalling more than the number completed in the first 11 years of Superfund.
- **Environmental Progress.** To date, at 3,000 sites, the Superfund program has treated, isolated, neutralized, or removed from the environment 13 million cubic yards of contaminated soil and solid wastes; 1 billion gallons of liquid waste; 6 billion gallons of contaminated groundwater; and 316 million gallons of polluted surface water. These actions have reduced potential risks to the 23

Superfund remediation at National Priority List sites.


Sites proposed to be added to NPL* (evaluation for immediate threat complete; action not begun) 26 (2.0%)
Sites on NPL with evaluation for immediate threat complete 30 (2.4%)
Emergency action taken investigation pending 10 (0.8%)
Site investigation and engineering study underway 396 (31.1%)
Cleanup remedy selected 78 (6.1%)
Cleanup design underway 212 (16.6%)
Cleanup construction underway 374 (29.3%)
All site cleanup construction complete ** 149 (11.7%)

* The Environmental Protection Agency, which administers Superfund, has asked for comments on its plans to add these sites to the National Priorities List (NPL), which would make them eligible for Superfund-financed permanent cleanup at costs potentially exceeding $2 million.

** As of October 31, 1992, all cleanup construction had been completed at 150 NPL sites.

Notes: Segments are cumulative; for example, managers of sites with construction underway have already completed the study, remedy selection, and design phases. As of September 30, 1992, of the 1,275 sites that had been or were proposed to be added to the NPL, 126 were located at federal facilities. The cleanup of these sites is the primary responsibility of the departments and agencies that operate them; by law, Superfund can not pay for their permanent cleanup.

Source: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC, 1992.

million people who live within four miles of a Superfund site, although such risks are difficult to quantify and depend on many variables.

• **Superfund Accelerated Cleanup Model.** Because the number of abandoned and uncontrolled hazardous waste sites far exceeds original estimates, EPA, in fiscal 1992, developed the Superfund Accelerated Cleanup Model. This management approach, which is being tested in 27 pilot projects nationwide, has the following features:

– Single-site assessments save time by eliminating redundant activities, resulting in earlier enforcement search and notification;

– Regional management decision teams prioritize the work load by

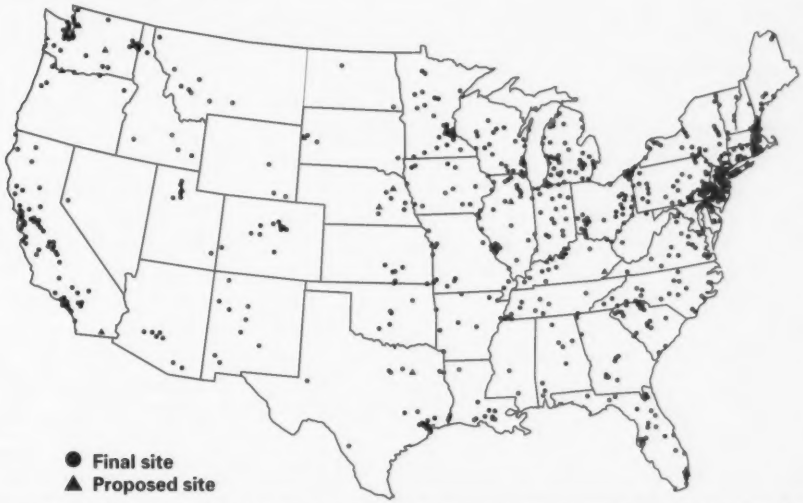
developing standardized cleanup methods for similar sites and promote innovative cleanup technology;
– Early action mechanisms address immediate threats to public health and safety in a timely manner; and
– Long-term action mechanisms help the public understand the extended time commitment required to complete cleanup of a Superfund site, once immediate threats are removed.

• **Remedy Selection.** Cleanup of the average Superfund site currently takes 7 to 10 years from listing to completion. EPA compresses each phase of remediation by qualifying fewer, better focused alternatives. Remedy-selection guidelines provide standard approaches for similar types of sites, such as municipal landfills and PCB-contaminated sites.

• **Cleanup Targets.** Having completed cleanup at nearly 150 sites as of November 1992, the Superfund program moved toward a target of 200 completed sites by the end of fiscal 1993 and 650 by the end of fiscal 2000.

• **Public Involvement.** EPA increasingly involves communities near

National Priority List sites.



Note: The 1980 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) authorized the Environmental Protection Agency to identify the nation's most seriously contaminated hazardous waste sites for inclusion on a National Priorities List (NPL).

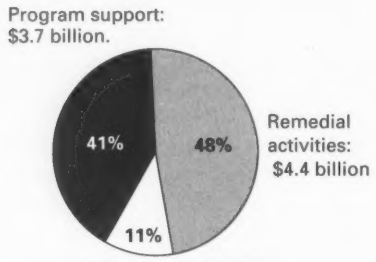
The map, based on September 1991 data, does not show Alaska, 6; Guam, 1; Hawaii, 2; and Puerto Rico, 9. National totals for 1991 and 1992 follow:

Year	Final sites	Proposed sites	Total NPL sites
1991	1,185	22	1,207
1992*	1,207	28	1,235

* Data are as of December 1992.

Source: U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, 1992.

Superfund costs.



Note: Data are through fiscal 1991, during which time Superfund appropriations totaled $9.1 billion. The Environmental Protection Agency estimates enforcement costs for fiscal 1992 and fiscal 1993 at $220 million per year.

Source: U.S. General Accounting Office, Washington, DC, 1992.

Superfund sites in cleanup decisions. New measures of cleanup success, based on protecting public health and the environment, initiate uniform outreach at the start and completion of each remedial action. Such measures enable the public to identify accomplishments within the Superfund cleanup process.

Innovative Technologies. Federal agencies are supporting the development of new cleanup technologies. Examples follow.

- EPA Technology Innovation Office. This office, created in March 1990, promotes development and use of new treatments for cleanup problems such as decontaminating soils and groundwater. Promising new treatments clean up contamination more quickly, more effectively, and less expensively. The EPA Superfund Innovative Technology Evaluation Program measures the effectiveness of new techniques for destroying, immobilizing, or reducing hazardous waste and contaminated materials. EPA has completed 41 full-scale field demonstrations of new technologies prior to commercialization and 14 laboratory and pilot-scale studies; and 91 new technologies are set for future evaluation. Projects include soil washing, chemical dechlorination, underground vacuum extraction, and forcing of airstreams through water to evaporate volatile organic compounds. EPA is evaluating bioremediation—the use of microbes to break down organic contaminants—at demonstration cleanups across the country. Through fiscal 1991 EPA had selected 210 new technologies for use in remedial actions at NPL sites.
- U.S. Bureau of Mines, Environmental Technology Division. This division is undertaking similar research in developing new technologies for immobilizing or reducing hazardous waste and contaminated materials resulting from mining and mineral processing. Most of the contaminates are inorganic. For example, techniques have been developed to recover lead from scrap batteries and to treat lead-contaminated soil at battery breaker superfund sites.

Municipal Solid Waste

The nation can address local solid waste disposal problems by reducing the amount and toxicity of waste generated or, using techniques such as recycling and composting, by reducing the amount of waste needing disposal. Federal standards help protect human health and the environment, but implementation of solid waste programs remains largely a state and local matter. In 1988 EPA set a national goal of a 25-percent reduction by the end of 1992 in the

amount of solid waste requiring disposal, using source reduction and recycling. Data for 1990 showed a national reduction in wastes of 21-23 percent, primarily through recycling. A sampling of current source reduction and recycling efforts follows.

Variable-Rate and Full-Cost Pricing. In 1992 EPA encouraged local and municipal governments to charge disposal fees that vary by the weight or volume of waste generated by a household or that reflect both the direct costs of the service and indirect environmental costs. The market signals sent by variable-rate and full-cost pricing create an incentive for households to reduce their waste stream and increase their recycling.

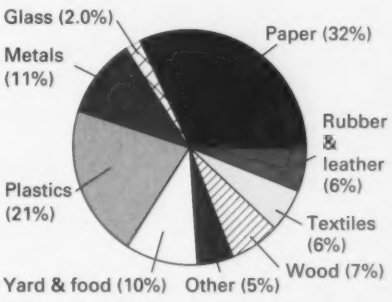
As an example, 39 percent of single-family-home garbage customers in Seattle in 1988 subscribed to have two or more cans picked up each week at a cost higher than single-can service. That same year, the city initiated curbside collection of recyclables and yard waste. The following year, the city increased the rate for multiple cans from $5 to $9 per month and lowered rates for homes that recycle. By 1991 customers subscribing for pickup of two or more cans had fallen to 11 percent, while those subscribing for pickup of less than one can had increased from 1 percent to 25 percent. Between 1987 and 1991, largely because of the revised variable-rate structure and initiatives on source reduction, recycling, and composting, the tonnage of residential solid waste disposed by the Seattle solid waste utility declined by 26 percent.

Federal Waste Reduction and Recycling. In response to the President's executive order of October 1991, requiring the U.S. government to promote waste reduction and recycling, 50 federal agencies named federal recycling coordinators and 36 submitted status reports on affirmative procurement programs to purchase products made of recycled materials. For more information, see the Federal Facilities Management section.

State and Local Recycling. Since 1988 local governments have increased the number of curbside-collection recycling programs by a factor of four. These programs now serve 65 million people. To assist state and local governments, federal agencies sponsor recycling initiatives, such as the following:

- An EPA Federal Procurement Hotline ;
- A procurement publication by the General Services Administration;
- An EPA solid waste information clearinghouse;
- EPA publications such as Markets for *Scrap Tires*, *Recycle Today*, and guides on composting and recycling materials.

Material discards in the 1990 municipal waste stream, by volume.



Note: Total volume = 412.2 million cubic yards; total weight = 162.2 million tons.

Source: See Part II, Table 91; and U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Characterization of Municipal Solid Waste in the United States*, (Washington, DC: EPA, 1992).

Chemical Emergencies

The Environmental Protection Agency (EPA) sponsors a cooperative program to ensure that local communities are prepared for accidents involving hazardous materials, to help reduce the number of accidents, and to assist in mitigating effects on public health and the environment should they occur. Participants include state, tribal, and local governments, industries, labor groups, environmental groups, and other stakeholders. The following laws and initiatives support state and local right-to-know and response planning:

Emergency Planning and Community Right-To-Know Act. Part of the Superfund Amendments and Reauthorization Act of 1986 (SARA), this law has two components:

- **Right-To-Know.** The Community Right-to-Know program involves reporting the presence and release of hazardous chemicals in communities, maintenance of the Toxics Release Inventory by EPA, and other measures to expand public access to such information.
- **Emergency Response Preparedness.** The 50 states and 6 U.S. territories have state emergency response commissions that oversee 4,000 local emergency planning committees. Local committees receive data on hazardous materials produced, used, or stored in their community; provide information to the public; and develop, update, and test emergency plans for responding to accidental releases of chemicals.

Clean Air Act Amendments of 1990. The CAA amendments require federal agencies to develop means of preventing and planning for chemical accidents that might discharge hazardous materials into the air.

Hazardous Materials Transportation Uniform Safety Act of 1990. This act establishes standards and provides for planning and training.

- **Transportation Standards.** The Department of Transportation (DOT) imposes standards for use by states and Native Americans in setting and enforcing routes for transportation of certain hazardous materials. In 1992 the DOT Research and Special Programs Administration (RSPA) issued a rule, establishing a national registration program for certain shippers and carriers of hazardous materials and a collection system to fund a national emergency response planning and training grant program.
- **Planning and Training Grants.** The act authorizes EPA to administer an assistance program that will award $12.8 million annually dur-

ing 1993-1998 to enhance preparedness and response capabilities of states and tribes.

Federal Response Plan. In 1992 EPA completed an interagency Federal Response Plan, with guidelines for responding to significant and catastrophic national emergencies, including earthquakes and hurricanes. EPA has lead responsibility for hazardous materials responses under the plan, which has the following components:

- **National Response Team.** Key to activating the plan, this team is chaired by an EPA official and includes representatives of the U.S. Coast Guard, the departments of the Interior, Defense, Energy, Agriculture, Commerce, Health and Human Services, Justice, Labor, Transportation, and State, the Nuclear Regulatory Commission, and the Federal Emergency Management Agency.
- **National Oil and Hazardous Substance Pollution Contingency Plan.** This plan, developed by EPA in coordination with members of the National Response Team, would assist in a national response to a chemical emergency.
- **EPA Emergency Operations Center.** This center would coordinate and monitor the federal response.
- **EPA National Incident Coordination Team.** Comprised of senior level officials from each of the major EPA pollution control offices and branches, this team would staff the Emergency Operations Center.

International Right-to-Know. The United States has been successful in using the community right-to-know program to provide a foundation for international chemical accident programs such as the following:

- **Organization for Economic Cooperation and Development.** OECD has developed a program called Guiding Principles for Chemical Accident Prevention, Preparedness, and Response;
- **United Nations Environment Program.** UNEP sponsors a program for developing countries called Awareness and Preparedness for an Emergency at the Local Level.
- **United Nations Conference on Environment and Development.** At UNCED in Rio de Janeiro in 1992, the United States championed inclusion of community right-to-know policies and toxic release inventories in the Agenda 21 list of actions that the 180 countries present agreed by consensus should be standards for all governments. The principle of community right-to-know also was included in the UNCED Rio Declaration.

Recycling on National Parks. Now in its third year, a program cosponsored by the National Park Service, Dow Chemical, and Huntsman Chemical is among the first and largest recreation recycling efforts. To date, 600,000 pounds of material in six national parks have been recycled through the program. In 1992 the National Mall in Washington, D.C., became the seventh participating national park. The 160 bins to be set up on the Mall will collect hundreds of tons of material per year. Dow and Huntsman are underwriting program costs, including the design and installation of recycling bins, collection of recyclables, informational exhibits, and technical support. Start-up costs for the Mall project are $250,000 for trucks and daily collection. In 1992 alone, Dow and Huntsman spent $500,000 on establishing new recycling in the seven national parks that together attract 23 million visitors each year.

Paper and Wood Recycling. The Forest Products and Harvesting Research Program of the USDA Forest Service has embarked on a national recycling effort to reduce by half the paper and wood in the municipal waste stream. Only 25 percent of the wood and paper discarded annually is recycled, while waste paper accounts for 40 percent of the volume in landfills. Scientists are seeking new technologies to make more efficient use of recovered paper, paperboard, and wood waste. They are working to improve the quality of recyclable material from paper and to develop alternative, nonpaper products from recycled wood fiber. They also are evaluating the economics of technologies for using recycled wood fiber and the economic and environmental impacts of expanded recycling.

Waste to Energy. In 1990, of all U.S. municipal solid wastes, 16 percent were combusted. Currently, 150 municipal waste-to-energy plants are in operation, combusting waste and converting 15 percent of the nation's solid waste into energy. In February 1991 EPA issued regulations for waste-to-energy plants, controlling air emissions of organics, heavy metals, and acid gases such as hydrochloric acid. Regulations ensure the maintenance of proper combustion conditions. Although combustion products—residue or ash—may be high in concentrations of heavy metals, they can be safely handled in landfills that meet the new national standards. The National Energy Strategy projects that waste-to-energy plants in the year 2010 will produce seven times the amount of power that they currently generate.

Landfills. In 1991 EPA issued regulations to improve the safety of municipal solid waste landfills to become effective in October 1993. New management standards cover the following categories of concern: location restrictions, operating requirements, design standards, groundwater monitoring and corrective action, closure and post-closure care, and owner/operator financial responsibility. Regulations cover facilities throughout their operating life and during their post-closure care period for 30 years. The rule may create an incentive for increasing source reduction and recycling nationwide because of the increased costs of disposal.

International Issues

Also see Biodiversity, Coasts and Oceans, Economics, Fisheries and Marine Mammals, Forestry, and related tables and figures in Part II.

In 1992 the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro in June, made front-page news of the linkages between environmental quality and economic development. Sustainable development —defined as managing the Earth's resources in a way that ensures their long-term quality and abundance— became the goal toward which nations committed themselves at home and at the "Earth Summit."

Conditions and Trends

During the past year, policymakers and the general public received a stream of scientific reports on the global nature of many environmental problems. Among the transboundary issues of greatest concern were biodiversity, forests, global climate change, oceans, and ozone-layer depletion.

Biodiversity

The biological wealth that scientists call biodiversity encompasses the Earth's variety of distinct species, the genetic variability within them, and the variety of ecosystems they inhabit. At the present time, no one has full and accurate information on the status and distribution of biodiversity components or on the functioning of ecosystems, but current evidence offers reason for concern.

Leading authority E.O. Wilson of Harvard University estimates that the current worldwide rate of extinctions exceeds 1,000 times the natural rate. Each of these losses from the world's natural heritage represents the potential loss of ecological, economic, and aesthetic benefits. The loss of biodiversity can result from a number of factors, particularly habitat loss and fragmentation, over-exploitation of species, introduction of intrusive species into an ecosystem, pollution, climate change,

and industrial agriculture and forestry. These factors are not confined to tropical regions but affect temperate ecosystems as well. For a discussion of conservation efforts, see the Biodiversity section.

Forests

Forests that provide services and products of ecological and economic value locally, nationally, regionally, and globally are under stress around the world. According to the 1990 assessment of the U.N. Food and Agriculture Organization, tropical forests are disappearing at a rate of 17 million hectares (42 million acres) per year. Responding to population pressures and poverty, many nations provide subsidies and incentives for forest conversion to farmland and pasture. Other causes include destructive logging practices; overharvest of commercial forests; subsidized timber sales; large-scale development projects; and lack of clearly defined property rights, leading to the "tragedy of the commons" problem.

Temperate and boreal forests, although expanding in some areas, are substantially degraded in others primarily because of air pollution, inefficient harvesting, and lack of reforestation. In some parts of Eastern Europe, forest dieback caused by air pollution is as high as 50 percent. For a discussion of conservation efforts, see the Forestry section.

Global Climate Change

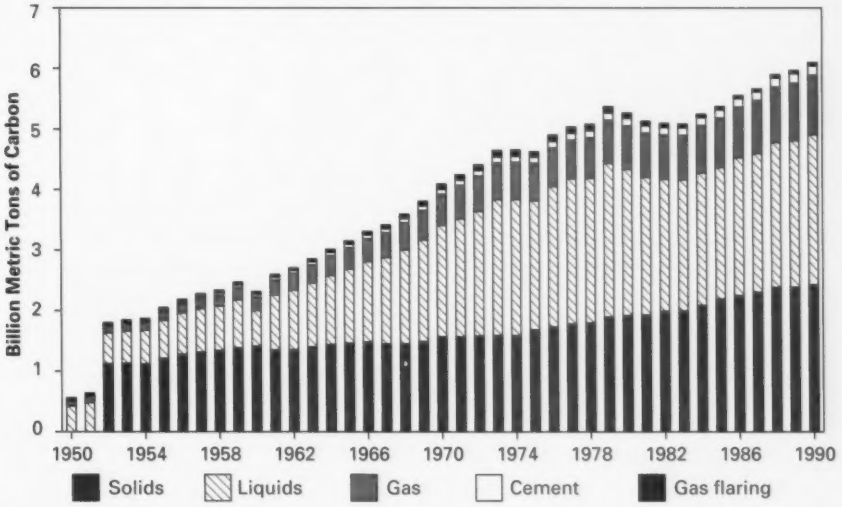
Certain atmospheric gases—including carbon dioxide, methane, and nitrous oxide—trap solar rays that would otherwise be radiated back into space. Without this "greenhouse effect," Earth would be uninhabitably cold. But many scientists believe rising emissions of greenhouse gases from human activity could lead to "global warming" and negative changes in sea level, frequency and intensity of storms, precipitation patterns, and incidence of droughts.

Greenhouse gases are emitted by various sources and stored in biological or chemical "sinks." Sources and sinks include the burning of fossil fuels such as coal and oil, industrial processes, changes in forest cover and land use, certain agricultural practices, and biodegradation of wastes. Greenhouse gas emissions occur in all nations; for example, the National Academy of Sciences estimated in 1983 that about 25 percent of worldwide carbon dioxide emissions from fossil fuel combustion arises in the United States, 25 percent in Western Europe and Japan, 25 percent from the former Soviet Union and Eastern bloc, and 25 percent from developing nations. Industrialized country shares are declining relative to those of developing countries.

The Intergovernmental Panel on Climate Change (IPCC), created under the auspices of the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP), issued its first assessment in 1990 on the science, impacts, and possible responses to climate change. The report projected a global average temperature rise of 0.2 to 0.5 degrees Centigrade per decade through the next century, if no actions are taken to limit net greenhouse gas emissions. Global temperature increases at that rate would be greater than any experienced in human history.

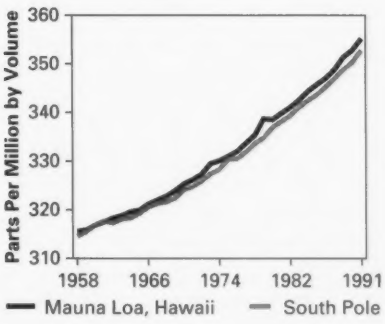
However, the IPCC report also noted uncertainties that hamper scientists in making accurate predictions about the timing, magnitude, and regional distribution of climate change. Key unknowns include the way carbon

Global emissions of carbon dioxide from human activities.



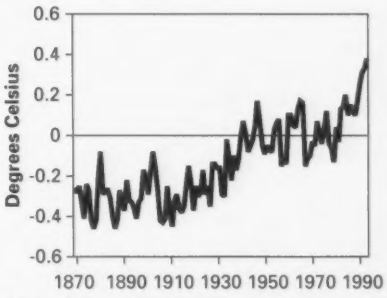
Source: See Part II, Table 38.

Atmospheric concentrations of carbon dioxide.



Source: See Part II, Table 41.

Global surface temperature variations.



Note: Global surface temperature is relative to a 1950-1979 reference period mean.

Source: See Part II, Table 44.

cycles through natural systems and the function of clouds, oceans, and biota as natural feedback mechanisms. In 1992 IPCC issued a brief report that included the following supplementary findings.

- Global average surface temperature is sensitive to atmospheric concentrations of carbon dioxide or its equivalent.
- Atmospheric concentrations of greenhouse gases have risen substantially over pre-industrial era levels.
- Global mean temperatures have risen 0.3 to 0.6 degrees Centigrade over the last century, but no definitive association can be made with human activity, nor will scientists be able to verify such a hypothesis for a decade or more.

- Chlorofluorocarbons (CFCs) and sulfate aerosols may offset greenhouse warming.
- Current assumptions used to compare the global warming potential of greenhouse gases may be inaccurate.

Oceans

The productive and regenerative capacities of the world's oceans are also threatened by pollution and over-utilization. Coastal regions, as sites with concentrated natural resources and human development, are particularly at risk. Habitats are being lost irretrievably to the construction of harbors and industrial installations, the development of tourist facilities and mariculture, and the growth of settlements and cities. Although difficult to quantify, destruction of beaches, coral reefs, and wetlands, as well as increased erosion of the shore, are evident all over the world.

In contrast to the coasts, the open sea remains relatively clean, although trends for certain species are of concern. Lead, synthetic organic compounds, and artificial radionuclides are widely detectable at very low levels. Small oil slicks and litter common along sea lanes are unsightly but, for the most part, of minor consequence to communities of organisms living in open-ocean areas. For discussions of efforts to conserve the world's ocean resources, see the Coasts and Oceans section and the Fisheries and Marine Mammals section.

Ozone-Layer Depletion

Significant findings emerged over the last year on the condition of the stratospheric ozone layer, which protects the Earth's surface from harmful levels of solar radiation. Early in the year, UNEP released its latest International Ozone Assessment, and findings were issued from the second U.S. Airborne Arctic Stratospheric Expedition. Both studies presented evidence that ozone depletion may occur more rapidly and widely than previously suspected, leading to concerns about potential increases in incidence of skin cancer, cataracts, and ecological damage. In the fall, the U.S. government announced additional troubling news: the widest ever ozone depletion over Antarctica.

Concern also emerged over a substance previously not recognized as an ozone-depleting chemical. The 1992 UNEP assessment identified methyl bromide as potentially having a high ability to deplete stratospheric ozone, although it noted a need for additional, intensive research. For many agricultural uses of methyl bromide, safe alternatives have yet to be identified.

Policies and Programs

In 1992 worldwide progress in protecting the ozone layer, endangered species, and regional air and water quality continued under various international agreements and U.S. initiatives. Most significantly, two years of preparations for the United Nations Conference on Environment and Development (UNCED) culminated in adoption of new international policies, embodied in The Rio Declaration, Agenda 21, and A Statement of Forest Principles. At UNCED, newly negotiated conventions on climate change and biodiversity were opened for signature.

The following update on major international environmental issues is presented in alphabetical order.

Antarctica. In October 1991 the United States and most other Antarctic Treaty Parties signed a protocol on environmental protection in Antarctica with provisions on the conservation of

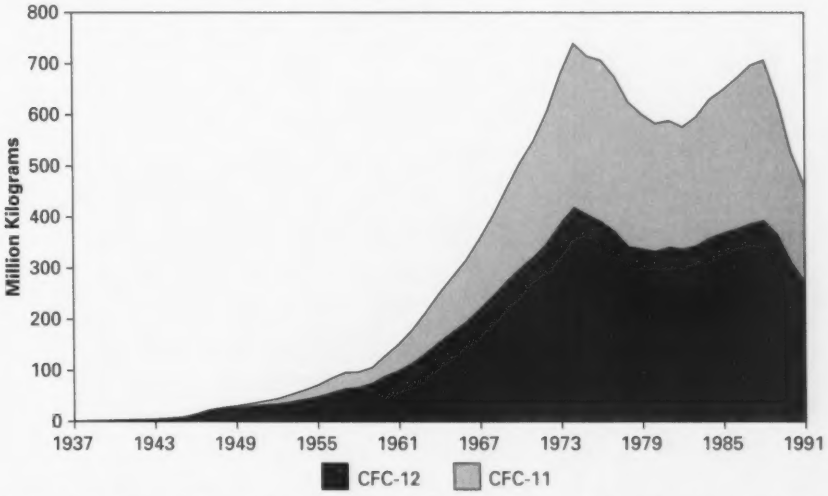
Chemicals that deplete the global ozone layer.

Chemical	Use	Lifetime in atmosphere *years*	Cease date for production & import
Chlorofuoro-carbons (CFCs)	Refrigerators, car air conditioners, foam cushioning & insulation, solvents, sterilants.	100	January 1, 1996**
Halons	Fire extinguishers, fire suppressant systems.	100	January 1, 1994**
Carbon tetra-chloride	Solvents, CFC production, chlorine & pesticides.	50	January 1, 1996**
Hydrochloro-fluorocarbons (HCFCs)	Home air conditioners, plastic insulation & packaging foam, some aerosols.	15	2030*
Methyl chloro-form	Industrial solvents for cleaning metal & electronics.	6	January 1, 1996**
Methyl bromide	Fumigation of soils, commodities and structures.	—	No deadline set***

* 99.5 percent phasedown by 2020.
** essential-use exemptions apply.
*** production freezed by 1995 at 1991 levels with decisions about future reductions (if any) to follow a program of intensive scientific and technologoical research and assessment.

Source: CEQ, 1992.

Global releases chlorofluorocarbons (CFCs).



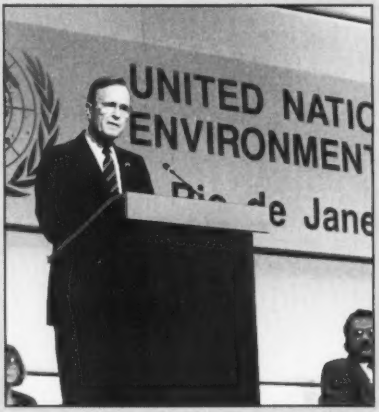
Note: Data, supplied by reporting companies participating in the Alternative Fluorocarbons Environmental Acceptability Study (AFEAS), were compiled by Grant Thornton Co., an independent auditor.

Source: Alternative Fluorocarbons Environmental Acceptability Study, *Production, Sales, and Atmospheric Release of CFC-11 and CFC-12 through 1991,* (Washington, DC: AFEAS, 1992), tables 1 and 2.

The Earth Summit

The United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, brought together 6,000 delegates from over 170 countries for discussions and negotiations on such topics as climate change, biodiversity, deforestation, desertification, oceans, technology cooperation, and economic relations between developed and developing nations. More than 150 heads of state, including President Bush, attended UNCED, committing their nations to greater cooperation on many of the most pressing challenges facing the world.

The White House.



President Bush addresses world leaders at the United Nations Conference on the Environment and Development in Brazil.

Held June 3-14, 1992, in Rio de Janeiro, Brazil, the Earth Summit produced three principal documents and two framework conventions. Summaries follow on these documents, the Forests for the Future Initiative, the two conventions opened for signature at UNCED, and the U.S. plan for UNCED follow-up.

Rio Declaration. This non-binding statement sets forth 27 basic principles that will guide environmental protection and economic development worldwide. U.S. negotiators emphasized the principles of public participation in decisionmaking, public access to information, environmental assessments, and market-based economic and environmental strategies.

Agenda 21. This 580-page action plan charts a course toward global sustainable development. Its 40 chapters propose specific approaches to issues such as the following:

- **Finance.** The result of intense negotiations, this chapter reflected a balance between the need for developing countries to mobilize internal resources for sustainable development and their need for additional assistance from industrial nations. The United States stressed realistic economic policies, the private sector's role in providing financial resources, and innovative methods of financing environmental protection, such as debt-for-nature swaps.
- **Forests.** Providing a common approach for countries to integrate national and international actions in the conservation and sustainable development of forests, this chapter calls for action in four areas: multiple roles of forests; protection, conservation, and sustainable management; promoting efficient utilization; and planning, assessment, and monitoring. The United States was especially active in forest issues at UNCED (see below).

• **Hazardous and Solid Wastes.** These chapters address key concepts such as waste prevention and minimization and call for ratification of the 1990 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.
• **International Institutions.** This chapter calls for a number of reforms:
– Stronger interagency coordination in the U.N. system;
– Enhanced roles for the U.N. Environment Program (UNEP), the U.N. Development Program (UNDP), and other U.N. agencies;
– Preparation and comparison of national plans for sustainable development;
– An enhanced role for nongovernmental organizations in U.N. deliberations and programs; and,
– Establishment of a Commission on Sustainable Development by the U.N. General Assembly. As a senior body of the Economic and Social Council (ECOSOC), such a commission would provide a forum for discussing national and multilateral experiences in implementing UNCED recommendations.
• **Oceans.** The oceans chapter includes comprehensive strategies addressing marine pollution from land-based activities and conservation of marine life. The United States successfully promoted the use of economic incentives to limit industrial and agricultural activities that pollute the seas. The United States also obtained language to ensure that populations of marine species are maintained at healthy levels, populations of endangered marine mammals are protected, and fishing gear is used that minimizes the incidental catch of nontarget species.

United Nations Conference on Environment and Development logo.

• **Technology Cooperation.** This chapter reflects U.S. efforts to highlight the concepts that make technology cooperation happen, such as protecting intellectual property rights, developing information networks, building indigenous technological capacity and regional research centers, and making effective use of technological assessment.
• **Toxic Chemicals.** This chapter proposes a structure for international work in chemical risk assessment and management that is likely to produce concrete results, given the prior momentum for international cooperation in this area. Reflecting lessons learned through the U.S. Community Right-to-Know Program (see "Toxics Release Inventory" in the Pollution Prevention section), the chapter encourages nations to establish similar programs. It also invites appropriate international organizations to develop guidance for such programs,

and encourages industry to adopt voluntary right-to-know programs in the absence of government requirements.

Statement of Forest Principles. At the initiative of President Bush, heads of state at the 1990 summit of seven industrial nations (the G-7) announced the goal of negotiating a legally binding, international agreement on forests. Many developing countries were reluctant to rush into an agreement that might limit use of their sovereign, revenue-producing forest resources. A consensus emerged to negotiate a "non-binding authoritative statement of principles for . . . the management, conservation and sustainable development of all types of forests." After two years of negotiations, a statement of forest principles was adopted at UNCED, calling on nations to ensure that forests are managed to meet the needs of present and future generations. It addresses the role of international cooperation, including financial and technical assistance, trade, and science. The United States and other G-7 nations continue to support the goal of a full-fledged forest convention.

Forests for the Future. On June 1, 1992, to accelerate momentum for international forest conservation, President Bush proposed the Forests for the Future initiative, aimed at ending net worldwide forest loss within a decade. The President called upon aid-giving nations to double worldwide assistance for forest conservation from $1.4 billion to $2.7 billion. Leading by example, he pledged to double U.S. bilateral forest assistance—an increase of $150 million annually. To match international commitment with domestic action, the President announced that the United States will end clearcutting as a standard timber harvest practice on federal forestlands, as part of a new ecosystem approach to the management of forests. The President's America the Beautiful initiative is already working to plant and maintain an additional one billion trees per year in the United States.

Climate Change Convention. At UNCED, the United States and more than 150 other countries concluded 15 months of negotiations by adopting the U.N. Framework Convention on Climate Change. The convention establishes the foundation for an international response to climate change with provisions such as the following:

- Nations must mitigate climate change through the design and implementation of national strategies that limit emissions of all greenhouse gases—the goal is to return emissions to the 1990 level by the year 2000—and enhance natural sinks of greenhouse gases such as forests.
- The treaty accommodates variations in the political and economic circumstances of nations, specifically avoiding uniform emissions targets and timetables for only one greenhouse gas, as proposed by some nations.
- Parties are encouraged to take account of climate change in developing economic, social, and environmental policies.
- Industrialized nations will provide assistance to developing countries, both in collecting data on net greenhouse gas emissions and in

limiting the rate of growth in emissions.
- The treaty defines a mechanism for providing financial aid to developing countries for certain incremental costs of projects that produce global environmental benefits.
- Nations will raise awareness of the causes and implications of climate change and associated response policies through public education and training.
- Nations will improve their capacity to observe, model, and understand the global climate system through a continuing program of internationally coordinated research.

The convention enters into force upon ratification by 50 countries. At UNCED, President Bush supported a "prompt start" in treaty implementation, including early discussions by industrialized countries of national action plans to control greenhouse gases (see "Climate Change National Action Plan" in this section). On October 13, 1992, at the President's urging, the U.S. Senate voted unanimously to ratify the treaty, making the United States the first industrialized nation, and the fourth overall, to do so.

Biodiversity Convention. As a pioneer in domestic biodiversity conservation, the United States worked over the past several years for an international convention to reduce worldwide loss of biodiversity. Unfortunately the complexity of the issues, combined with international pressure to have a final text before UNCED, resulted in a convention unacceptable to the United States. At UNCED, President Bush stressed that the United States voluntarily would exceed the conservation-related provisions of the convention, but he rejected as unwise the convention's provisions on intellectual property rights, government access to genetic information in biotechnology, and financial assistance.

The U.S. commitment to biodiversity conservation is consistent with provisions of *Agenda 21.* In response to the call made at UNCED for increased research, the United States proposed a plan to foster international cooperation on biodiversity surveys, inventories, and data organization. The United States plans to host a meeting of international experts in 1993 to consider such topics as data gathering and reporting standards, approaches to inventories, surveys, and data management, and institutional issues. Efforts are underway to develop a National Biodiversity Center to coordinate and make such information available in the United States.

UNCED Follow-Up in the United States. In his remarks at Rio, President Bush emphasized the need for follow-through on commitments made there. In August 1992, under a cabinet-level policy coordinating group, the Department of State and the Council on Environmental Quality began to review action items in *Agenda 21,* comparing them to existing U.S. programs. This review will help identify priorities for further action, facilitate work on a U.S. sustainable development strategy, and provide the framework for U.S. participation in the work of the U.N. Commission on Sustainable Development.

flora and fauna, waste disposal, marine pollution, environmental impact assessment, and protected areas. The protocol prohibits the mining of mineral resources for at least 50 years. Pursuant to the protocol, Antarctic Treaty parties convened a meeting of experts on environmental monitoring in Buenos Aires in June 1992.

The Arctic. A number of meetings took place concerning the Arctic Environmental Protection Strategy (AEPS), adopted in 1991 by the United States and seven other Arctic Rim nations. Topics included conservation of fauna and flora and response to environmental emergencies. AEPS participants have established the Arctic Monitoring and Assessment Program, with a secretariat located in Norway.

Canada. In March 1992 the United States and Canada released the first progress report under the 1991 U.S.-Canada Air Quality Accord. Initial emphasis has been on acid rain and visibility. The two nations established a bilateral Air Quality Committee and increased the exchange of experts and information on North American air quality matters.

The two countries continued to work on Great Lakes protection, implementing a Great Lakes Toxic Air Pollution Deposition-Monitoring Program. In October 1992 the Convention on Environmental Impact Assessment in a Transboundary Context was presented to the U.S.-Canada International Joint Commission, and negotiations continued on guidelines for implementation.

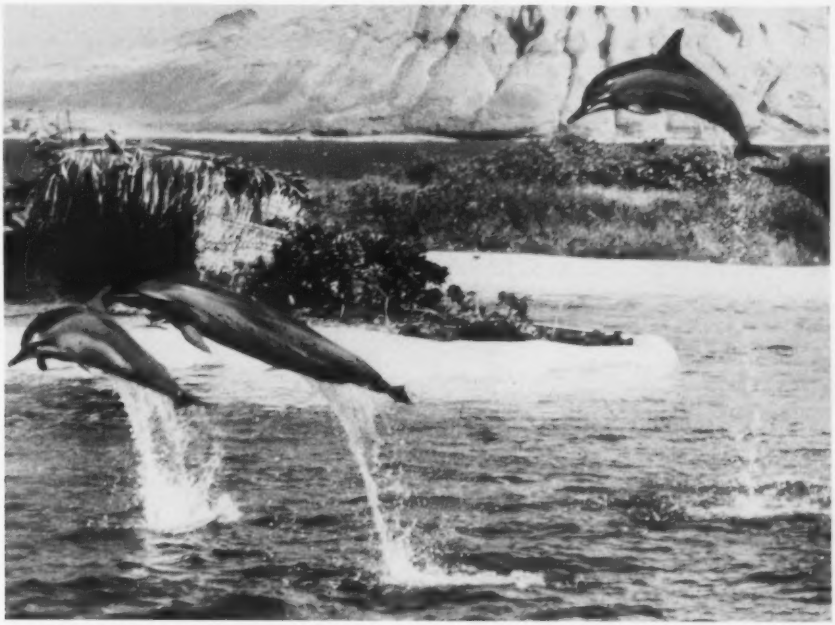
Canada joined the United States and Mexico in agreeing to establish a North American Commission on the Environment in parallel to the development of the North American Free Trade Agreement (see the NAFTA discussion in the Economics section). In September 1992 EPA, Environment Canada, and the Mexican Secretariat of Social Development signed a memorandum of understanding on environmental education.

Climate Change National Action Plan. The United States presented initial elements of its national action plan at negotiating sessions for the U.N. Framework Convention on Climate Change in 1991 and added further measures in May 1992. These actions will limit net greenhouse gas emissions in the year 2000 to 6-11 percent below baseline projections, a limited increase of 1-6 percent above 1990 levels. The U.S. national action plan, published for public comment in the Federal Register (December 8, 1992) included several dozen measures, a sampling of which follows.

- Creating stronger standards and incentives for energy efficiency in the industrial, commercial, housing, and transportation sectors;
- Accelerating the development and production of vehicles that operate on clean fuels such as natural gas, electric batteries, and biofuels;
- Capturing methane from landfills, mines, and agricultural sources;
- Research and development of high-performance aircraft engines, high-speed railroads, intelligent highway systems, industrial waste reduction and recycling systems, efficient coal technologies, safer nuclear reactors, and solar and wind energy technologies; and
- Research and planning for adaptation to climate change, focusing on coastal and freshwater resources, forests, and agriculture.

Because net greenhouse gas emissions are rising most rapidly in develop-

U.S. Department of Commerce, NOAA.



In 1992 the United States and nine other nations adopted a dolphin conservation program for the eastern tropical Pacific Ocean. For more information, see the Fisheries and Marine Mammals section.

ing and newly industrialized nations, the United States pledged $25 million in fiscal 1993-1994 to assist such countries in conducting climate change country studies. Such studies would emphasize the following topics:

- Vulnerability of developing countries to climate change;
- Inventories of sources and sinks of greenhouse gases;
- Technological options for limiting emissions and adapting to climate change; and,
- Feasibility of specific climate-related projects.

The United States hosted a Country Studies Workshop in September 1992 in Berkeley, California, and continued to fund over half the world's scientific research on climate change.

The U.S. Global Change Research Program is designed to reduce key scientific uncertainties and to develop more reliable scientific predictions upon which sound responses to global change can be based. Results from this work are available to the international scientific community.

An Inter-American Institute for Global Change Research was established in June 1992 under U.S. leadership. The institute is a network of centers engaged in basic research on global change processes of special interest to the Americas. The institute could be the first of several research centers worldwide to examine global change processes at the regional level.

Convention on International Trade in Endangered Species. As a

party to the Convention on International Trade in Endangered Species of Fauna and Flora (CITES), the United States participated in the eighth conference of the parties in March 1992 in Kyoto, Japan. Among decisions reached by the conference, parties agreed to continue listing the African elephant and ban all trade in ivory. For the first time, CITES discussed the possible listing of commodity species such as blue fin tuna and several tropical timbers and listed several varieties of mahogany. Delegates decided to reevaluate scientific criteria upon which listing actions are based. The treaty is evolving to deal with a future in which trade issues and species conservation will become increasingly intertwined. The United States will host the ninth conference of CITES parties in late 1994.

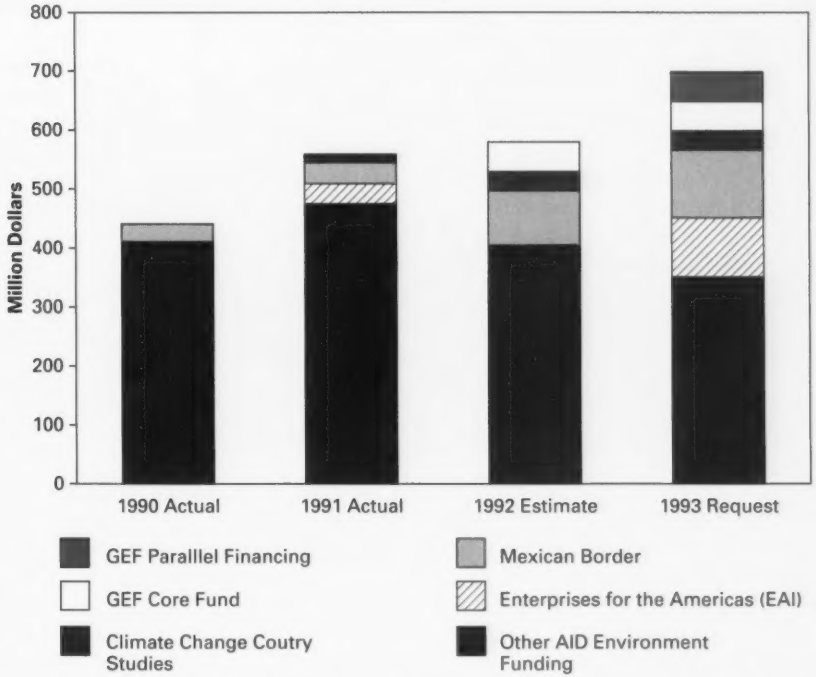
In 1992 Congress enacted legislation that will facilitate U.S. implementation of CITES resolutions on exotic birds. The bill regulates imports of exotic birds whose populations may be adversely affected by trade. It also authorizes assistance to wild bird management efforts in other nations.

Eastern and Central Europe. Building on existing bilateral accords and using funds provided under the Support for Eastern European Democracy Act of 1989, the United States continued to assist countries in the region with development of environmental legislation and institutions. The United States also provided technical assistance and financial support for activities such as energy efficiency centers in Prague and Warsaw.

Enterprise for the Americas Initiative. The United States continued to implement the Enterprise for the Americas Initiative (EAI), launched by President Bush in 1991. The agreement aims to expand free trade throughout the Americas, stimulate economic reform and investment liberalization, and ease debt burdens. The debt-reduction plan includes innovative debt-for-nature swaps as a mechanism to support environmental protection and conservation. Under the plan, the United States and eligible nations will establish the terms for reduction of certain official debt (PL-480 debt); payment of interest on the remaining debt will be made in local currency and deposited into trust funds supporting environmental projects in the host country. Local nongovernmental organizations will play a prominent role in planning trust-fund expenditures through membership on an oversight board. Participating countries qualify for the program by implementing macroeconomic and trade policies conducive to free-market development. In February 1992 the United States signed an EAI environmental framework agreement with Chile, and similar agreements are in effect with Jamaica and Bolivia.

Global Environment Facility. The Global Environment Facility (GEF) was established in 1990 as a 3-year pilot project to provide financial and other assistance to developing countries for innovative environmental projects that provide global benefits. The World Bank, the United Nations Development Program (UNDP), and UNEP serve as joint implementing agencies for the facility. GEF funds can be used for projects in the areas of global warming, ozone-layer protection, protection of biodiversity, and international waters. At UNCED, the facility was named the interim financial mechanism for both the Framework Convention on Climate Change and the Biodiversity Convention. Four rounds or tranches of GEF

U.S. financial assistance to protect the global environment.



GEF Parallel Financing. The United States requested these funds to support the Global Environmental Facility (GEF), a 3-year pilot project established in 1990 and co-managed by the United Nations Development Program (UNDP), the United Nations Environment Program (UNEP), and the World Bank to assist developing countries in protecting the global environment.

GEF Core Fund. The United States is providing these funds within the parameters of the 1993 budget.

Climate Change Country Studies. The United States pledged an additional $12.5 million in fiscal 1994 for the following projects:

- **Montreal Protocol Fund.** The Congress provided $15 million in fiscal 1992.
- **Brazil Rain Forest.** The United States pledged $20 million to this pilot project in fiscal 1992—$5 million for a trust fund and $15 million for bilateral cofinancing over several years.

Mexican Border. These funds are being spent in Mexico rather than on U.S. border activities.

Enterprise for the Americas Initiative (EAI). As a result of U.S. debt forgiveness, host countries contribute these funds in local currency to protect the environment. The Congress did not approve the $100 million requested in fiscal 1992; the $135 million requested for fiscal 1993 reflected a June 1992 estimate of country eligibility for U.S. debt forgiveness.

Other AID funds. The U.S. Agency for International Development (AID) used these funds to support other global environmental activities.

Source: U.S. Agency for International Development, Budget Office, and Office of Management and Budget, Washington, DC, 1992.

projects have been submitted to participating countries for approval.

Latin America and the Caribbean. In 1992 the Protocol Concerning Specially Protected Areas and Wildlife in the Caribbean Region (the SPAW Protocol) went to the U.S. Senate for its advice and consent to ratification. The protocol builds on existing international obligations to establish specially protected areas to preserve rare or fragile ecosystems, especially the habitats of threatened or endangered species.

Multilateral Development Banks. In 1992 the United States continued its efforts to encourage the World Bank and other multilateral development banks to integrate environmental considerations into lending practices, as required by the Pelosi Amendment. For example, prior to action by the World Bank Board, the U.S. executive director scrutinizes the potential environmental impacts of proposed bank projects and withholds support for those with significant potential impacts unless an environmental impact assessment or comprehensive summary of alternatives has been made available to affected parties, nongovernmental organizations, and World Bank executive directors at least 120 days in advance of a board vote. This U.S. policy has resulted in greater use of environmental impact assessments and public review of proposed projects in developing countries.

The World Bank developed new policies in 1992 for agriculture, water resource management, and energy efficiency and conservation. Reforms, undertaken at U.S. urging, strengthened linkages between environment and development goals in lending programs. For example, in October 1992 the World Bank completed a series of studies on energy conservation in the United States and in newly industrialized Asian countries, adopting a policy to make greater use of integrated resource planning—a tool that illuminates alternatives to powerplant construction. Policy shifts resulted in increased consultation with affected groups and nongovernmental organizations. The United States urged regional development banks to undertake similar reforms.

Formal discussions regarding a tenth replenishment of funding for the International Development Association (IDA) continued through most of 1992. U.S. negotiators demanded that IDA activities include full public participation and address environmental considerations.

North American Free Trade Agreement (NAFTA). The intersection of environmental and trade concerns received unprecedented attention in 1992. Trade liberalization, generally associated with increases in national incomes, provides financial resources that can be devoted to environmental protection. At the same time, the economic growth generated by open trade can have significant environmental consequences. For a discussion of NAFTA, the landmark event of 1992 in the area of trade and the environment, see the Economics section.

Ozone-Layer Depletion. In August 1992 amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer entered into force for the United States and 19 other countries. Parties to the Montreal Protocol and its 1990 amendments have agreed to phase out the production of chlorofluorocarbons (CFCs) and other ozone-depleting substances by the end of the century.

In February 1992, in response to scientific evidence indicating that ozone

Parties to the Montreal Protocol.

Note: Countries that have formally ratified, acceded, approved, or accepted the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, as of October 31, 1992.

Source: U.S. Department of State, Bureau of Oceans and International Environmental and Scientific Affairs, 1992.

depletion may be occurring more rapidly and widely than previously believed, President Bush took the following actions:

- Accelerated the U.S. phaseout deadline to the end of 1995—four years ahead of the Montreal Protocol deadline;
- Called on other nations to ratify the Montreal Protocol and amendments and accelerate phaseout deadlines;
- Asked U.S. producers to speed progress in the near term by cutting 1992 output to half of 1986 levels, even though the protocol allowed producers to be at 80 percent.

By early 1992 U.S. production of CFCs had dropped more than 40 percent below 1986 levels largely as a result of innovative market-based mechanisms such as fees and tradable allowances.

Parties to the Montreal Protocol created the Interim Multilateral Fund in 1990 to assist developing countries undergoing the transition to CFC-replacement technologies. Total contributions to this voluntary 3-year fund rose from $160 million in 1991 to $200 million in 1992 and likely will increase substantially in 1993.

Technology Cooperation. The United States supports technology cooperation with developing countries and countries with economies in transition to help them find environmentally sound paths to economic growth and development. Technology cooperation takes the following forms:

- **Information Exchange.** A new Environmental and Energy Efficient Technology Transfer Clearinghouse, sponsored jointly by USAID, EPA, and the Department of Energy (DOE) will provide information on pollution control, renewable energy, and energy-efficient technologies. Pilot programs have been established in Mexico City and at the U.N. Industrial Development Organization (UNIDO) in Vienna.
- **Training and Technical Assistance.** The Environmental Training

Institute shares U.S. environmental advances with developing countries by providing training courses to foreign executives. At UNCED, President Bush proposed an Environmental Technology Cooperation Corps to engage the U.S. private sector with counterparts abroad in the diffusion of environmentally sound management and technology.

• **Capacity Building.** The United States has established an Energy Efficiency Center in Russia to complement similar centers previously established in Eastern Europe. The purpose of the centers is to reduce energy-related wastes by increasing indigenous expertise and resources devoted to energy efficiency.

• **Technology Transfer and Development.** The United States promotes technology transfer and development through efforts that include the following DOE programs:

– **ADEPT.** The ADEPT program (Assisting Deployment of Energy Practices and Technology) encourages joint ventures between U.S. national laboratories and industrial groups working in integrated project teams with developing country counterparts.

– **America's 21st Century.** Through this program, DOE assists the U.S. renewable energy industry in forming joint ventures in Latin America and the Caribbean.

U.S.-Asia Environmental Partnership. In January 1992 President Bush announced the United States-Asia Environmental Partnership (US-AEP), involving U.S. and Asian businesses, governments, and community groups in a program that includes technology cooperation, environmental fellowships and training, and conservation of regional biodiversity. More than 25 Asian countries are eligible to participate in the partnership, coordinated by a working group co-chaired by USAID and the Department of Commerce and including 17 other federal agencies.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) is the nation's environmental magna carta. With passage of NEPA in 1969, the United States adopted a national policy to "encourage productive and enjoyable harmony between man and the environment" and to direct federal agencies, to the fullest extent possible, to interpret and administer U.S. policies and laws in accordance with this policy. NEPA established the Council on Environmental Quality (CEQ) to advise the President and assist federal agencies with compliance, and the act mandated procedural requirements to fulfill its substantive goals.

Conditions and Trends

To help ensure that consideration of environmental values is systematic in federal decisionmaking, NEPA section 102(2)(C) requires preparation of a "detailed statement" for "major federal actions significantly affecting the quality of the human environment." The "detailed statements" have come to be called environmental impact statements (EIS), and the process underlying the preparation of those statements by federal agencies has come to be called the environmental impact assessment or NEPA process.

CEQ has promulgated regulations to implement the procedural provisions of NEPA (40 CFR Parts 1500-1508). The primary purpose of these regulations is to ensure that federal agencies consider the substantive goals of NEPA in the course of decisionmaking and that the public and environmental agencies are involved in that process.

Over the years, some observers have come to associate NEPA implementation more with documentation of environmental analysis than with the substance of the analysis itself. However as CEQ regulations state:

> Ultimately, of course, it is not better documents but better decisions that count. NEPA's purpose is not to generate paperwork—even excellent paperwork—but to foster excellent action.

NEPA Glossary

The National Environmental Policy Act of 1969 (NEPA) requires federal agencies to consider the environmental impacts of major federal actions, weigh alternatives, and seek public participation early in the planning process. The following are terms introduced by NEPA regulations promulgated by CEQ:

- **Environmental Assessment (EA).** This concise public document analyzes the environmental impacts of a proposed federal action and provides sufficient evidence to determine the significance of impacts.

- **Findings of No Significant Impact (FONSI).** This public document briefly presents the reasons why an action will not have a significant effect on the human environment and therefore will not require the preparation of an environmental impact statement.

- **Environmental Impact Statement (EIS).** This is the "detailed statement" required by NEPA when an agency proposes a major federal action that significantly affects the quality of the human environment. An EIS must include an analysis of reasonable alternatives to the proposed action.

- **Record of Decision (ROD).** This public document reflects an agency's final decision, rationale behind that decision, and commitments to monitoring and mitigation.

- **Cumulative Impact.** This impact on the environment results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The purpose of NEPA then is protection of the environment, not production of paperwork. Many federal agencies are striving to better integrate NEPA goals with their own policies and actions. To recognize and encourage such efforts, CEQ developed a Federal Environmental Quality Awards Program to showcase model NEPA compliance in two categories:

- Exemplary Action Award, based on a specific example of an environmental impact analysis; and
- Exemplary Agency Award, presented to the agency that best demonstrates a consistently high standard of performance in the NEPA process.

CEQ asked each federal department to nominate one exemplary action and one

agency within that department. The Environmental Protection Agency (EPA) also nominated agencies in both categories based on its experience in reviewing environmental impact analyses. Award recipients will be recognized in future CEQ annual reports.

Policies and Programs

As part of its NEPA oversight responsibilities, CEQ sponsored a number of initiatives during 1992. A sampling follows.

NEPA Regional Conferences

During 1991 and 1992 CEQ hosted five regional conferences that focused on ecological issues in NEPA analyses. The conferences, cosponsored by EPA with assistance from the Department of Defense and the U.S. Fish and Wildlife Service, were held in Denver, Atlanta, Boston, Chicago, and Anchorage. They afforded CEQ the opportunity to meet with NEPA practitioners in the field to discuss methods for implementing national policies that relate to conserving biodiversity. Experts in biodiversity conservation spoke at each conference, and NEPA practitioners presented papers and case studies on methods of incorporating ecological principles into the NEPA process. Methods include geographic information systems (GIS) and data available through The Nature Conservancy's Natural Heritage Program. In addition, CEQ devoted a segment of each conference to the purpose, theory, and practice of preparing environmental assessments. After reviewing information gained from the conferences, CEQ will issue a report on biodiversity in NEPA analyses. CEQ intends to issue guidance to the federal agencies on NEPA consolidation in the EA process.

Environmental Assessment Survey

In 1992 CEQ surveyed federal agencies to determine whether EAs are facilitating effective NEPA compliance. The survey, which covered 45,000 EAs prepared during the year, also showed that while the EA process often facilitates mitigation, many agencies do not use EAs as originally envisioned by the regulations in three significant respects:

- Agencies rarely use an EA to determine whether an EIS is necessary;
- Agencies prepare EAs that are often quite lengthy and correspondingly costly;
- Agencies appear to rely heavily on mitigation measures to justify EAs and FONSIs.

The survey results suggest that some agencies have avoided preparing EISs based on the erroneous perception that preparation of EAs does not require public involvement. However, the results also indicate that increased reliance on EAs may be attributed in part to early NEPA integration in agency planning, which results in mitigation measures being incorporated into a project site and design, with adverse environmental effects consequently reduced or eliminated. The survey results are available in their entirety from CEQ.

Cumulative Impact Analysis

While most federal managers recognize the need to assess the cumulative impacts of agency actions, EISs are often limited in scope. As a result, EISs frequently miss the big-picture effects of individual proposals, and litigation ensues. While a consensus exists on the need to evaluate cumulative effects,

federal agencies do not all agree on the methodology or conceptual approach to that analysis.

To promote dialogue on this issue, CEQ hosted workshops to develop methodological approaches to cumulative impact analysis. The Council is collecting case studies on how agencies conduct analyses, and a handbook in preparation will incorporate different agency approaches. CEQ also is working with the Canadian Federal Environmental Assessment Review Office to share information regarding approaches to cumulative impact analysis.

International Activities

CEQ is involved in several interagency efforts regarding environmental impact assessment (EIA) in the international context.

Protocol on Environmental Protection. CEQ helped to develop legislation for the Protocol on Environmental Protection signed in 1991 by the United States and other Antarctic Treaty parties. The Council also worked with the National Science Foundation to draft EIA regulations to implement the Protocol.

Pelosi Amendment. CEQ is involved in an interagency process to ensure that, pursuant to the Pelosi Amendment (22 U.S.C. 262m), the U.S. executive director of each multilateral development bank abstains from voting on loan proposals that have a significant impact on the environment unless the proposal is accompanied by an environmental assessment or comprehensive environmental summary received at least 120 days before the board votes on the proposal.

Convention on Environmental Impact Assessment in a Transboundary Context. In February 1992 the United States signed the Convention on Environmental Impact Assessment in a Transboundary Context, which was negotiated under the auspices of the Economic Commission for Europe. CEQ is developing guidelines to implement the Convention for projects with significant adverse transboundary environmental impacts.

Technical Assistance. Other countries frequently ask CEQ to assist them in formulating an EIA process. In 1992 CEQ staff met with delegations from Russia, Spain, Cameroon, Malawi, Egypt, Korea, China, Japan, France, and Italy, among others, to discuss the NEPA process and its role in federal decisionmaking. In addition, a CEQ attorney assisted officials from the Turkish Ministry of the Environment in drafting EIA procedures.

NEPA Training

In 1992 CEQ undertook a NEPA training initiative to ensure that quality NEPA education and training are available across the country. As part of the initiative, CEQ compiled a compendium of NEPA courses currently offered by federal agencies, universities, and private entities. Copies are available from CEQ. A sampling of courses in which CEQ took part follows.

Justice Department Course. In February 1992 the Legal Education Institute of the Department of Justice (DOJ), assisted by CEQ, presented a NEPA course designed for government lawyers in Washington, D.C. The course is being offered again in January 1993 in Seattle, Washington.

University Short Courses. In November 1992 CEQ cosponsored an annual week-long NEPA course at the Duke University School of the Environment. The course will be repeated in March 1993.

American Bar Association Course. CEQ and DOJ lawyers helped organize a NEPA course sponsored by the American Law Institute of the American Bar Association in Washington, D.C., in November 1992.

Federal Leadership Training. During the year, CEQ participated in leadership-training courses for federal agency personnel, including courses sponsored by the Federal Executive Institute and the Office of Personnel Management Executive Seminar Centers.

Agency Implementation

In 1992 agency implementation of NEPA regulations produced the following developments.

Emergency Alternatives. CEQ regulations provide for alternative compliance arrangements in the event of emergency circumstances.

- **Department of Energy.** In July 1991 the Department of Energy (DOE) and CEQ reached an agreement regarding alternative NEPA arrangements for the immediate drawdown of Par Pond at the closed Savannah River nuclear weapons facility. CEQ concurred with DOD that the weakened state of the Par Pond Dam constituted an emergency under CEQ regulations and that drawdown of the pond was necessary to avert a potentially damaging and life-threatening flood in the case of dam failure. Alternative NEPA arrangements included preparation of a special assessment and implementation of specific mitigation measures.
- **Agency for International Development.** When the Mount Pinatubo volcanic eruption in the Philippines was followed by the rainy season, the Agency for International Development consulted with CEQ regarding EIA procedures for disaster assistance. Consultation with CEQ also took place for the shipment of emergency supplies of fuel and food to the Bosnia area.
- **Department of Defense.** Hurricane Andrew, which devastated south Florida in August 1992, virtually destroyed Homestead Air Force Base. Seeking to relocate some essential missions, the Department of Defense (DOD) sought CEQ assistance in ensuring that temporary relocation of activities were conducted in compliance with NEPA. In consultation with CEQ, DOD committed to preparing EAs for each relocation, with public involvement in preparation of documents to the extent practicable. DOD agreed to contact CEQ immediately for additional consultations on appropriate alternative NEPA arrangements, if an EA indicated that significant environmental impacts might occur as a result of relocation.

Agency NEPA Regulations. In 1992 after consultations with CEQ, DOE, the USDA Forest Service, and the Bureau of Land Management published new agency NEPA regulations. CEQ also consulted with the following agencies in the process of publishing new NEPA regulations or revising existing ones: the Office of Surface Mining, Bureau of Mines, Bureau of Indian Affairs, Indian Health Service in the Department of Health and Human Services, and National Indian Gaming Commission.

Agency Workshops on NEPA Implementation. In addition to regional conferences, CEQ also participated in the following NEPA workshops:

- **Federal Agency Workshops.** CEQ took part in workshops on

NEPA implementation issues sponsored by federal agencies, including EPA, DOE, the Department of the Army and Army Corps of Engineers, the Minerals Management Service, National Park Service, and Fish and Wildlife Service. Conferences on Native Americans and the environment included the First National Tribal Conference on Environmental Management, held in Cherokee, North Carolina, and the annual Bureau of Indian Affairs NEPA workshop.

• **Environmental Impact Assessment Conferences.** CEQ took part in conferences on environmental impact assessments sponsored by EPA Regions III and IV, the Advisory Committee on Intergovernmental Relations, and the American Association of Law Schools Environmental Law Committee.

NEPA Case Law

In 1992 NEPA case law included decisions by the United States Supreme Court and by federal courts of appeal and district courts.

Old Growth Timber Sales

Robertson v. Seattle Audubon Society, 112 S.Ct. 1407 (1992)

The case concerned challenges to the policy of the USDA Forest Service and the DOI Bureau of Land Management (BLM) to allow the harvesting and sale of timber from old-growth forests in the Pacific Northwest. The Portland Audubon Society originally brought suit against BLM in 1987, and the Seattle Audubon Society challenged Forest Service decisions in 1989. Congress, attempting to resolve the issues raised in these cases, passed section 318 of the Department of the Interior and Related Agencies Appropriations Act of 1990, which went into effect on October 23, 1989.

Section 318 mandated a specified volume of timber sales, established a timber management plan for national forest and BLM lands in Oregon and Washington, and prohibited sales in identified spotted owl habitat areas. It also declared that management of areas according to subsections (b)(3) and (b)(5) of this section on the 13 national forests in Oregon and Washington and BLM lands in western Oregon known to contain northern spotted owls is adequate consideration for the purpose of meeting the statutory requirements that are the basis for the consolidated cases captioned *Seattle Audubon Society et al. v. F. Dale Robertson*, Civil No. 89-160; *Washington Contract Loggers Assoc. et al. v. F. Dale Robertson*, Civil No. 89-99 (order granting preliminary injunction); and the case *Portland Audubon Society et al. v. Manuel Lujan, Jr.*, Civil No. 87-1160-FR. Pub. L. No. 101-121, 103 Stat. 701, 754-50, § 318(b)(6)(A). Based on section 318, the district court in *Seattle Audubon* vacated its preliminary injunction, and the district court in *Portland Audubon* granted the government's motion to dismiss.

On appeal, plaintiffs in the consolidated cases claimed that section 318 violates the separation of powers doctrine and was thus unconstitutional. The Ninth Circuit Court of Appeals agreed, holding that the Congress had not repealed or amended the environmental laws underlying the litigation but rather had endeavored to instruct the federal courts to reach a particular result in specified pending cases (*Seattle Audubon Society v. Robertson*, 914 F.2d 1311 (9th Cir. 1990)).

The United States Supreme Court, however, reversed the court of appeals and concluded that section 318 compelled changes in the law, not findings or results under old law. The citations to specific lawsuits, said the Court, "served only to identify the five 'statutory requirements that are the basis for' those cases . . ." To the extent that the applicable language affected the adjudication of those cases, it did so by modifying the provisions at issue. Further, the Court noted that the Congress may amend substantive law in an appropriations statute as long as it does so clearly and found that congressional intent in section 318 was "not only clear, but express."

Justiciability: Finality and Standing

Foundation on Economic Trends v. Lyng, 943 F.2d 79 (D.C. Cir. 1991)

Plaintiffs sought an injunction and declaratory judgment against the Department of Agriculture (USDA) for failure to prepare an EIS for the USDA "germplasm preservation program." On the merits, the district court granted summary judgment for defendants on the ground that plaintiffs had failed to identify a proposal for which an EIS should have been prepared under NEPA.

Before reaching the merits, the Court of Appeals for the District of Columbia Circuit questioned plaintiffs' standing under the recent Supreme Court decision in *Lujan v. National Wildlife Federation*, 110 S.Ct. 3177 (1990). First, the court noted that when a party seeks judicial review of agency action under the Administrative Procedure Act (APA), as in this case, plaintiffs must identify the agency action affecting their interests and must demonstrate that the interest sought to be protected is arguably within the zone of interests to be protected by the statute.

Next, the court explained that plaintiffs in the instant case claimed informational standing, that is, injury based on the absence of information contained in an EIS. The court concluded, however, that under the Lujan decision, an agency's refusal to prepare an EIS was not a particular agency action that could be the source of injuries sufficient to confer standing. Plaintiffs in NEPA cases must point to an action at least arguably triggering the agency's obligation to prepare an EIS.

Based on this analysis, the court held that the germplasm preservation program for which plaintiffs sought the preparation of an EIS was not an identifiable action or event. "Plaintiffs fail to target their complaint to a particular proposal for federal action and fail to identify any revisions or changes taken by any of the defendants in the germplasm program that would trigger the obligation to prepare an environmental impact statement under NEPA." The court vacated the judgment in the lower court and remanded the case with instructions to dismiss the complaint for lack of jurisdiction.

Public Citizen v. Office of the U.S. Trade Representative, No. 92-5010, 1992 (D.C. Cir. Aug. 7, 1992) (available on WESTLAW, CTADC database, WESTLAW No. 186568)

Plaintiffs claimed that the President and the U.S. Trade Representative were required to prepare EISs for negotiation of a North American Free Trade Agreement (NAFTA) and the Uruguay Round of multilateral trade negotiations under the General Agreement on Tariffs and Trade. The district court dismissed the

suit on the ground that plaintiffs lacked standing to pursue their claims, and it also noted ripeness problems.

The Court of Appeals for the District of Columbia Circuit concluded that plaintiffs had failed to identify a final agency action within the meaning of the Administrative Procedure Act (APA). The basis for judicial review of NEPA claims is final agency action under the APA. In the absence of a final agreement in either the NAFTA or Uruguay Round negotiations, and the possibility that no final agreements would result, the court concluded that no final agency action under the APA existed, and the district court therefore did not have jurisdiction. The Court of Appeals, accordingly, affirmed the dismissal.

Following the President's announcement of a NAFTA agreement on September 12, 1992, Public Citizens filed a new action to compel preparation of an EIS only with respect to the NAFTA, *Public Citizens v. USTR*, No. 92-2102 (filed September 15, 1992). Public Citizens filed a motion for summary judgment on October 15, 1992.

Natural Resources Defense Council v. Lujan, 768 F.Supp. 870 (D.D.C. 1991)

National and local Alaskan environmental organizations challenged a legislative EIS (LEIS) prepared by defendants in 1987, concerning the future management of the Arctic National Wildlife Refuge (ANWR) and subsequently filed a motion for a preliminary injunction to compel defendants to circulate as a draft supplemental LEIS a report issued by defendants in 1991. In a motion to dismiss, defendants argued, among other things, that plaintiffs lacked standing under NEPA, that the NEPA claims plaintiffs sought to raise were not justiciable under the separation of powers doctrine, and that a statutory conflict between the Alaska National Interest Lands Conservation Act (ANILCA) and NEPA prevented defendants from revising the 1987 LEIS. The court held that plaintiffs had standing to challenge the adequacy of the LEIS under NEPA and issued a declaratory judgment that defendants had violated NEPA by not issuing the 1991 report as a supplemental LEIS.

Before reaching the standing issue, the court noted that earlier litigation between the same parties on procedural aspects of the issuance of the 1987 LEIS had resulted in a determination that the LEIS did not fall within the modified procedures for legislative proposals found in the CEQ regulations. Those regulations exempt legislative EISs from the requirement that an EIS be prepared in two stages, permitting an agency to transmit a single LEIS to the Congress, other agencies, and the public for review and comment. This modified procedure is not available, however, where "[t]he proposal results from a study process required by statute." The ruling in the earlier case, according to the court, had consequences in the instant case because it meant that the 1987 LEIS was subject to the same requirements as any EIS.

With respect to standing, plaintiffs alleged that the failure of the 1987 LEIS to comply with NEPA, ANILCA, and the APA made the LEIS so inadequate that the Congress would not have the full information it needed to make a decision on the future use of ANWR; if an uninformed Congress acted to allow oil exploration in ANWR, it would adversely affect plaintiffs who use and enjoy the area. In addition, plaintiffs alleged that the deficiencies in the 1987 LEIS adversely affected their public

participation rights because the data and analyses in it were flawed.

The court found plaintiffs to have alleged that the inadequacies of the 1987 LEIS created "a risk that serious environmental impacts will be overlooked" and concluded that this sufficed to establish injury in fact. Since plaintiffs had alleged that they used and enjoyed the area, they had met both the requirement of geographical nexus and the requirement that their interests be within the NEPA zone of interests:

> There is no doubt that "recreational use and aesthetic enjoyment" are among the sorts of interests that NEPA was specifically meant to protect.

Plaintiffs' participatory rights were also found to be within the zone of interests protected by NEPA:

> If a decision subject to NEPA . . . is made without the information that NEPA seeks to put before the decisionmaker, the harm that NEPA seeks to prevent occurs.

On the separation of powers argument, the court ruled that the exercise by the Congress of its legislative powers would not nullify any declaratory relief the court might grant. A legislative EIS is not simply a legislative aid but rather serves in part to ensure that the public has an opportunity to participate meaningfully in decisionmaking at the administrative and legislative levels. Accordingly, the court held that the requirement of an adequate EIS for legislative proposals can be enforced by a private right of action.

The court also rejected defendants' argument that ANILCA overrides or repeals NEPA, thus precluding the revision or supplementation of the 1987 LEIS. ANILCA by its terms does not repeal NEPA, and repeal by implication is disfavored. In the context of NEPA, which requires federal agencies to comply with its mandate to "the fullest extent possible," courts have been especially reluctant to hold that another statute overrules it.

As to the merits of plaintiffs' claim regarding whether the 1991 report should be circulated as a supplement to the 1987 LEIS, the court first reiterated the finding of the earlier litigation that the 1987 LEIS fell into the exception to the exemption in the CEQ regulations for legislative EISs. Addressing defendants' argument based on the conclusion that a legislative EIS must be prepared in two stages did not mean that it must also be supplemented, the court then noted that "[a]n agency's duty under NEPA is a continuing one." So long as the decisionmaking process is still pending, the dissemination of relevant environmental information will be promoted by supplementation.

Having determined that the 1987 LEIS was subject to supplementation, the court found that the information contained in the 1991 report was "significant" as that term is defined in the CEQ regulations, although it was not environmental information and no change occurred in assessed impacts on the environment. Citing earlier NEPA cases, the court held that supplementation is required where new information so alters a project's character that a new "hard look" at the environmental consequences is necessary, even where the change is not strictly environmental. The court noted that defendants considered the new information in the 1991 report to be important inasmuch as it included new geologic as well as economic data and supported the 1987 LEIS recommendation of full oil leasing in ANWR's coastal plain. Because the

information contained in the 1991 report was significant, the court held that defendants' failure to issue and circulate that report as a supplemental LEIS was a violation of NEPA. The United States has filed a notice of appeal.

Decision to Prepare an EIS

Roanoke River Basin Association v. Hudson, 940 F.2d 58 (4th Cir. 1991), cert. denied, 112 S.Ct. 1164 (1992)

The Army Corps of Engineers issued a permit to the City of Virginia Beach to construct a water-intake structure and pipeline to divert water from Lake Gaston—part of the Roanoke River system—to Virginia Beach's water supply. Prior to issuing the permit, the Corps prepared an environmental assessment on this proposal and concluded that, with mitigation, the environmental impacts would not be significant and the preparation of an EIS was not required. Plaintiffs challenged the Army Corps decision not to prepare an EIS in light of the possible impact that the pipeline might have on the striped bass population of the Roanoke River.

Affirming a lower court's finding in favor of the Army Corps, the Court of Appeals for the Fourth Circuit held that if a mitigation condition eliminates all significant environmental effects, no EIS is required. The only significant impact alleged was the impact on striped bass, and the Army Corps determination that a mitigation condition would eliminate any adverse impact was supported by the record. The court also noted that the existence of a disagreement between the Army Corps and other federal agencies as to the need for an EIS is not by itself grounds for a court to require an EIS.

Supplementing an EIS

Coker v. Skidmore, 941 F.2d 1306 (5th Cir. 1991)

In this decision, the Court of Appeals for the Fifth Circuit overturned the district court's determination that a supplemental EIS had to be prepared prior to construction of a 5.4-mile levee on the Yazoo River in Mississippi. The levee construction was part of the Yazoo River Basin Flood Control Project, for which the Corps of Engineers prepared a programmatic EIS in 1975. The District Court found that the 1975 EIS was outdated and thus had to be supplemented before the levee construction could proceed.

The court of appeals overturned the district court's ruling, because the lower court had not evaluated the case using the CEQ and Corps NEPA standards for supplementation. The CEQ regulations (40 CFR § 1502.9(c)) state that an agency must supplement an EIS if the agency makes substantial changes in the proposed action relevant to environmental concerns, or if significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts arise. The district court explicitly found no evidence that construction of the levee would have a significant environmental effect. The court noted that an EIS need not be supplemented "whenever new information concerning a project comes to light...or when portions of it become out of date."

Functional Equivalent Doctrine

Western Nebraska Resources Council v. EPA, 943 F.2d 867 (8th Cir. 1991)

In relevant part, the Court of Appeals for the Eighth Circuit found that EPA need not comply with NEPA prior to its actions under the Safe Drink-

ing Water Act (SDWA). Following a long line of cases dealing with EPA administration of pollution control laws, the court found that the SDWA is the "functional equivalent" of the NEPA process and thus, adherence to NEPA formal requirements is not necessary.

Environmental Assessments

Sierra Club v. James D. Watkins, No. 88-3519 (34 E.R.C. 2057, D.D.C. Dec. 9, 1991; available on LEXIS, Genfed library, Dist file, LEXIS No. 17482)

This case dealt with NEPA compliance for the importation of spent nuclear fuel rods from Taiwan to the United States. The court found the EA prepared by DOE to be inadequate, despite finding that plaintiffs had failed to demonstrate that the proposed action would have a significant environmental impact. The court upheld the DOE FONSI for the project.

The court premised what it acknowledged to be an unusual opinion on a discussion of the purpose and function of EAs. While acknowledging that one function is to determine whether the proposed action will have significant environmental impacts and thus require preparation of an EIS, the court relied on that portion of the CEQ regulation which states that an EA serves to aid an agency's compliance with NEPA, where no EIS is necessary (40 CFR §1508.9(a)(2)). The court found further support for its determination that EAs have an independent function in section 102(2)(E) of NEPA, which requires agencies to "study, develop and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources."

The court noted that the examination of alternatives was bounded by the "rule of reason" and that the level of analysis should be concomitant with the severity of the impacts. In this instance, however, the court found both the agency's choice of alternatives and analysis of cumulative risks of radiation exposure to be inadequate. The court also ruled that DOE should have considered risks associated with a worst case scenario, without discussing the 1986 amendment to the CEQ regulations related to that issue.

Natural Resources Defense Council v. Duvall, 777 F.Supp. 1533 (E.D.Cal. 1991)

In this case, the district court found that the Bureau of Reclamation FONSI for proposed regulations to implement provisions of the Reclamation Reform Act could not be sustained. The court first discussed the differences it perceived between the standards for review of the adequacy of an EIS and review of a FONSI determination. It decided not to follow the United States Supreme Court choice of the arbitrary and capricious standard in *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360 (1989), which concerned a decision to prepare a supplemental EIS. Rather, in reviewing the Bureau decision not to prepare an EIS *ab initio*, the court chose to follow what it perceived as the less deferential "reasonableness" standard.

The court found the FONSI to be insufficient in several respects. First, the court, finding no applicable reference in CEQ regulations or guidance, saw "no apparent reason" to believe that incorporating information by reference is appropriate in the context of an EA. The court noted that even if incorpora-

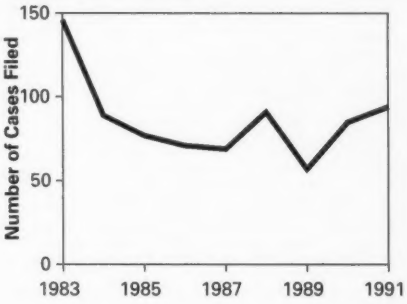
tion by reference was permissible in an EA, the requirements set forth in the applicable CEQ regulation (40 CFR § 1502.21) were not adhered to in this instance.

Second, the court disputed economic assumptions made in the EA, as well as the reasonableness of the EA conclusions. The court also faulted the analysis for focusing primarily on California case studies, although the regulations would apply in other western states. Finally, the court found that in light of explicit language in the Reform Reclamation Act requiring the Secretary of the Interior to consider water measures, the EA improperly omitted consideration of an alternative regulatory program that focused on water conservation measures. The United States has appealed the decision to the Ninth Circuit.

NEPA Trends

A total of 94 cases involving a NEPA claim were filed against federal departments and agencies in 1991, up slightly from 1990. In those cases, 14 injunctions were issued. The Department of Transportation was the most frequent defendant with 24 cases filed against it. The Department of the Interior was second with 13 cases, and the Army Corps of Engineers was third with 11 cases.

NEPA cases filed.



Source: CEQ, Cumulative NEPA Litigation Survey, 1992.

As in previous years, the most common complaint, the cause of action in 41 cases, was no EIS when one should have been prepared. An inadequate EIS was the second most common complaint, raised in 26 cases. Individuals or citizens groups were the most common plaintiffs (41 cases), followed by environmental groups (37 cases).

In 1992 the number of draft, final, and supplemental EISs filed by federal agencies increased over those filed in 1991, with federal agencies filing a total of 512 EISs.

Abbreviations for Federal Agencies

AIR	DOD Department of the Air Force
ARMY	DOD Department of the Army
COE	DOD Department of the Army, Corps of Engineers
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
HUD	Department of Housing and Urban Development
NAVY	DOD Department of the Navy
NRC	Nuclear Regulatory Commission
NSF	National Science Foundation
STATE	Department of State
TVA	Tennessee Valley Authority
USDA	Department of Agriculture
USPS	United States Postal Service

Cumulative NEPA Litigation Survey, 1970-1991.*

Year	Cases filed	Injunctions	Most frequent defendant	Most frequent plaintiff	Most common complaint	Second most common complaint
1974	189		DOT, HUD			
1975	152					
1976	119		DOT, DOI, HUD	Citizen and Environmental Groups	No EIS	Inadequate EIS
1977	108		DOT, DOD, DOI	Citizen and Environmental Groups	No EIS	Inadequate EIS
1978	114		DOT, DOD, DOI, HUD, EPA	Citizen and Environmental Groups, Individuals	No EIS	Inadequate EIS
1979	139	12	DOT, HUD, DOI, USDA, DOD	Environmental Groups, Citizen Groups, and Individuals	No EIS	Inadequate EIS
1980	140	17	DOT, DOI, DOD, HUD, EPA	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS
1981	114	12	DOD, DOT, DOI, USDA, HUD, NRC	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EIS
1982	17	19	DOI, COE, DOT, USDA, HUD, EPA	Individuals or Citizen Groups, Environmental Groups	Inadequate EIS	No EIS
1983	146	21	DOI, DOT, USDA, FERC, NRC	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS

Litigation Survey, (continued)

Year	Cases filed	Injunctions	Most frequent defendant	Most frequent plaintiff	Most common complaint	Second most common complaint
1984	89	14	USDA, DOI, DOT	Environmental Groups, Individuals or Citizen Groups	Inadequate EIS	No EIS
1985	77	8	DOT, DOI, COE, FERC	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EIS
1986	71	16	DOT, DOI, USDA	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS
1987	69	3	DOI, DOT, USDA	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EA and EIS
1988	91	7	COE, USDA, DOI, DOT	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EIS
1989	57	5	USDA, DOT	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS
1990	85	11	DOT, COE, EPA	Environmental Groups, Individuals or Citizen Groups	No EIS	Inadequate EIS
1991	94	14	DOT, DOI, ARMY	Individuals or Citizen Groups, Environmental Groups	No EIS	Inadequate EIS

* 1970-1975: A cumulative survey on these years was published in the 1976 CEQ Annual Report. By June 30, 1975, 332 NEPA cases had been completed, resulting in 54 injunctions; 322 cases were still pending with 65 injunctions. The most frequent defendants were the departments of Transportation and Housing and Urban Development.

Source: CEQ, 1992.

NEPA cases by agency, 1990.

Agencies	Number of cases filed	Number of 1990 cases resulting in injunctions	Number of injunctions in 1990 from pre-1990 cases
Department of Transportation	24	3	1
Department of Agriculture	14	3	0
Department of the Interior	13	4	2
Department of the Army, U.S. Army Corps of Engineers	11	1	0
Department of Energy	6	1	0
Department of Commerce	4	0	0
Federal Energy Regulatory Commission	4	0	0
Department of the Navy	3	0	0
Department of the Army	2	1	2
Department of Housing and Urban Development	2	1	0
Environmental Protection Agency	2	1	0
Nuclear Regulatory Commission	2	0	0
Department of the Air Force	1	0	0
Department of State	1	0	0
National Science Foundation	1	0	0
Tennessee Valley Authority	1	0	0
United States Postal Service	1	0	1
Total	94	14	4

Source: CEQ, 1992.

Types of complaints filed under NEPA, 1991.

Causes of action	Number for 1991 cases	Number for pre-1991 cases resulting in injunctions in 1991
Inadequate Environmental Impact Statement	26	
No Environmental Impact Statement, when one should have been prepared	41	
Inadequate Environmental Assessment	20	
No Environmental Assessment, when one should have been prepared	12	4
No Supplemental Environmental Impact Statement, when one should have been prepared	6	
Other	23	
Total	128	4

Source: CEQ, 1992.

Plaintiffs for NEPA lawsuits, 1991.

Types of plaintiffs	Number for 1991 cases	Number for pre-1991 cases resulting in injunctions in 1991
Environmental groups	37	3
Individuals or citizen groups	41	1
State governments	4	
Local governments	5	1
Business groups	5	
Property owners or residents	16	
Indian tribes	2	
Other	0	
Total	112	5

Source: CEQ, 1992.

Plaintiffs and issues for 1991 NEPA cases, by federal agency.

Plaintiffs and issues	Federal agencies																
	EPA	FERC	NSF	AIR	NRC	USPS	ARMY	COE	DOC	USDA	DOE	HUD	DOI	NAVY	STATE	DOT	TVA
Plaintiff																	
Environmental groups	2	1					1	6	2	7	3		7	2	1	4	1
Individuals or citizen groups	1	3		1	2		1	5	2	5	2	1	5	2		12	1
State governments		1									2		1				
Local governments						1		1		1						2	
Businesses									1							5	
Property owners or residents		2								2		2	1	1		7	1
Indian tribes										1	1						
Other																	
Total	3	7	1	1	2	1	2	12	5	16	8	3	14	5	1	30	2
Issue																	
Inadequate EIS		1			2			1		4	3		5			11	
No EIS	1	3				1	2	10	1	4	5	1	2	1	1	9	
Inadequate EA		1				1		4	1	6	3		2	1	1		
No EA								2	1	1			2			4	1
No supplemental EIS										1						5	
Other	1		1	1						1		1	3	1		14	
Total	2	5	1	1	2	2	2	17	4	17	11	2	14	3	2	43	1

Source: CEQ, 1992.

Environmental impact statements filed by federal agencies.

Agency	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Agriculture	172	104	102	89	59	65	117	118	75	68	89	136	145
Commerce	54	53	36	25	14	24	10	8	9	3	5	8	13
Defense	1	1	1	1	1	0	0	0	2	0	0	0	0
Air Force	8	3	7	4	6	5	7	8	9	6	11	19	20
Army	40	9	14	3	6	5	5	2	10	8	9	9	21
COE	182	150	186	127	119	116	106	91	76	69	40	46	45
Navy	11	9	10	6	4	9	8	13	9	6	4	19	9
Energy	28	45	21	24	19	14	4	13	11	9	6	11	2
EPA	84	71	96	63	67	42	16	18	19	23	25	31	16
GSA	13	11	13	8	1	0	4	0	1	3	0	4	3
HUD	170	140	140	93	42	13	15	18	6	2	7	5	7
Interior	126	131	107	127	146	115	105	98	110	117	61	68	64
Transportation	277	189	221	183	169	147	126	110	101	96	90	100	87
TVA	9	6	4	0	2	1	0	1	0	0	0	3	0
Other	98	44	76	55	22	21	26	15	17	20	23	18	24
Total	1,273	966	1,033	808	677	577	549	521	455	430	370	477	456

Source: U.S. Environmental Protection Agency, Office of Federal Activities, unpublished data, 1991.

Notes: Years refer to calendar years. Number of EISs includes draft EISs, EIS supplements, and final EISs filed during the specified year. Some proposed projects may have several draft and final EISs filed over a period of years. COE= U.S. Army Corps of Engineers. HUD=Department of Housing and Urban Development. EPA=U.S. Environmental Protection Agency. GSA=General Services Administration. TVA=Tennessee Valley Authority.

Environmental impact statements filed by federal agencies during 1991.

Agency	Totals by subject matter	Totals
Department of Agriculture		145
Natural gas and oil: drilling and exploration	5	
Natural gas and oil: transportation, pipeline, storage	1	
Power facilities: transmission	2	
Watershed protection and flood control	5	
Mining	1	
Irrigation, desalination of return flows, agricultural water supply	1	
Parks, recreation areas, wilderness areas, national seashores	19	
Forestry and range management	85	
Mining (non-energy)	11	
Pesticides and herbicide use	10	
Weather modification and methodology	2	
Dredge and fill	1	
Other water projects	2	
Department of Commerce		13
Wetlands, estuary and ocean use: sanctuary, disposal, and other	9	
Fisheries	4	
Department of Defense		
Department of the Air Force		20
Military installations: conventional, chemical, nuclear, and other	16	
Defense systems	4	
Department of the Army		21
Military installations: conventional, chemical, nuclear, and other	18	
Munitions facilities	2	
Forestry and range management	1	
Department of the Army, Corps of Engineers		45
Military installations: conventional, chemical, nuclear, and other	1	
Beach erosion, hurricane protection, river and lake bank stabilization	4	
Navigation	7	
Multi-purpose impoundments	6	
Dredge and fill	4	
Watershed protection and flood control	15	
Other water projects	3	
Bridge permits	1	
Parks, recreation areas, wilderness areas, national seashores	1	
Pesticides and herbicide use	1	
Fisheries	1	
Space programs	1	

EISs by agencies, (continued)

Agency	Totals by subject matter	Totals
Department of the Navy		7
Power facilities: conservation and other	1	
Military installations: conventional, chemical, nuclear, and other	4	
Dredge and fill	1	
Research and development (not already covered)	1	
Department of the Navy, Marine Corps		2
Military installations: conventional, chemical, nuclear, and other	2	
Department of Energy		2
Nuclear development: (fuel and other)	1	
Power facilities: transmission	1	
Environmental Protection Agency		16
Mining	1	
Hazardous and toxic substance disposal	1	
Sewage treatment and sewage facilities	4	
Municipal and industrial water supply systems not multi-purpose impoundments	1	
Mining (non-energy)	1	
Wetlands, estuary, and ocean use: sanctuary, disposal, and other	7	
Miscellaneous information	1	
General Services Administration		3
Buildings for federal use	3	
Department of Housing and Urban Development		7
Pesticide and herbicide use	1	
Buildings, federally licensed or assisted (including production facilities)	6	
Department of the Interior		64
Nuclear development (fuel reactors and other)	1	
Mining	2	
Natural gas and oil: drilling and exploration	8	
Municipal and industrial water supply system not multi-purpose impoundments	2	
Irrigation, desalination or return flows, agricultural water supply	1	
Multi-purpose impoundments	1	
Watershed protection and flood control	2	
Land acquisition or disposal, management jurisdiction transfer	4	
Parks, recreation areas, wilderness areas, national seashores	14	
Forestry and range management	9	
Mining (non-energy)	6	

EISs by agencies, (continued)

Agency	Totals by subject matter	Totals
Department of the Interior (continued)		
Comprehensive resource management	8	
Pesticides, herbicides use	1	
Housing subdivisions and new communities	2	
Drainage	1	
Wetlands, estuary and ocean use: sanctuary, disposal, and other	1	
Natural gas and oil: transportation, pipeline, storage	1	
Department of Transportation		87
Road construction	68	
Airport improvements	7	
Bridge permits	3	
Mass transportation	7	
Weather modifications and methodology	2	
Federal Energy Regulatory Commission		8
Natural gas and oil: transportation, pipeline, storage	5	
Power facilities: hydroelectric	3	
National Aeronautics and Space Administration		1
Space programs	1	
National Science Foundation		2
Research and development (not already covered)	2	
Nuclear Regulatory Commission		1
Nuclear development: fuel reactors and other	1	
Department of Justice		6
Prison construction	6	
Department of Veterans Affairs		6
Cemetery development	6	
Total federal EISs		456

Source: U.S. Environmental Protection Agency, Office of Federal Activities, unpublished data, 1992.

Pollution Prevention

Also see Federal Facilities Management, Hazardous and Solid Wastes, Private Sector Initiatives, and related tables and figures in Part II.

It is the national policy of the United States that pollution should be prevented or reduced at the source. The Pollution Prevention Act of 1990 gives the force of law to the common sense notion that very often, the best, most economically efficient way of reducing the impact of society's waste on the environment is to make less of that waste in the first place. Pollution prevention means changing the way the nation produces and consumes goods and services so that fewer pollutants are generated, and as a result, fewer pollutants are released into the environment.

Conditions and Trends

Federal initiatives, spurred on by the Pollution Prevention Act, have contributed to recent increases in the nationwide acceptance of the principles of pollution prevention.

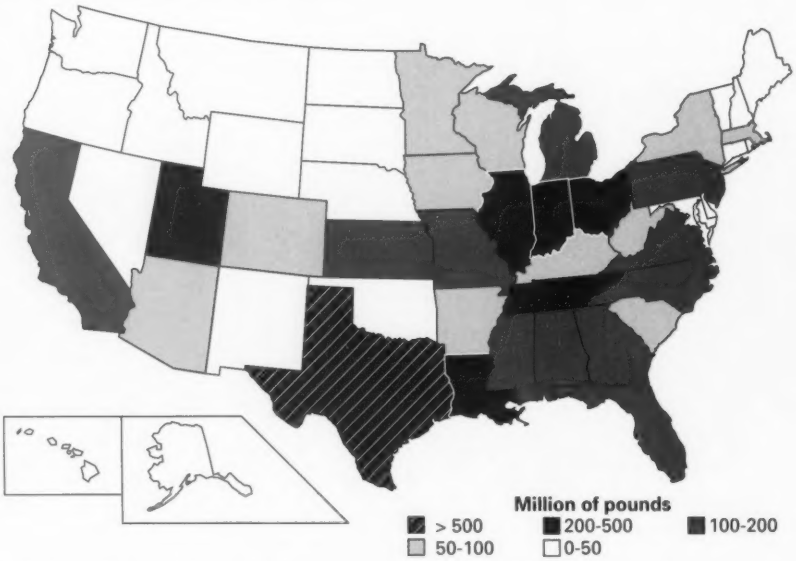
State Legislation

In addition to federal legislation, 27 states now have pollution prevention laws. Most of these laws, enacted since 1987, target hazardous and solid wastes, and one state, Iowa, includes air emissions. Many follow the example of the federal Pollution Prevention Act and include a waste management hierarchy with the preferred option—pollution prevention or source reduction—at the top, followed next by environmentally sound recycling and finally by waste treatment and disposal. Some of the laws extend technical and financial assistance to waste generators to speed pollution prevention efforts, and others require waste generators to formulate facility-wide pollution prevention plans. Such plans help the generators analyze their waste streams and identify opportunities for pollution prevention.

Toxics Release Inventory

The 1986 Emergency Planning and Community Right-to-Know Act requires many sources of toxic emissions and transfers to report the amount of such releases and transfers publicly. Public concern about toxic chemicals

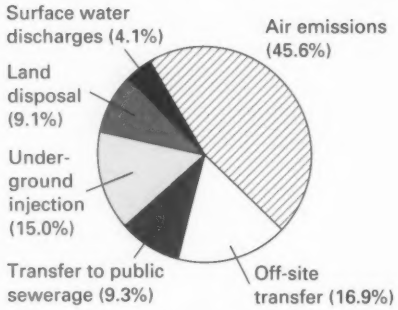
TRI total releases and transfers.



Notes: TRI = the Toxics Release Inventory maintained by the Environmental Protection Agency. Data are current as of 1990. Correlations between TRI releases and risks to human health and the environment depend on many variables.

Source: U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, 1990 Toxics Release Inventory, Public Data Release, Washington, DC, 1992.

Environmental distribution of TRI releases and transfers.



Source: See Part II, Table 95.

has created a parallel incentive for companies to cut emissions and transfers voluntarily. Pursuant to the Community Right-to-Know Act, the Environmental Protection Agency (EPA) maintains a Toxics Release Inventory (TRI).

In 1990 releases and transfers of toxic chemicals measured by TRI showed an 11-percent decrease (600 million pounds) to 4.8 billions pounds of toxic chemicals released into the environment or transferred. Releases into the air totaled 2.2 billion pounds, a 14-percent decrease from the 1989 level of 2.5 billion pounds. Releases to land decreased from 454 million pounds in 1989 to 440 million pounds in 1990. Releases into lakes, rivers, and other bodies of water increased by 2 percent, or 4 million pounds.

Municipal Solid Waste

Americans generated 4.3 pounds of

municipal solid waste per person per day in 1990, an 8-percent increase over the 1988 level. EPA estimates that the amount of waste generated will increase through the end of the decade but at a slower rate, reaching 4.5 pounds per person per day by the year 2000. Efforts to promote source reduction, production of more durable products, and backyard composting could help to further slow or even reverse this trend.

Policies and Programs

The federal government promotes pollution prevention through regulatory and enforcement actions, cooperation with state and local governments and private sector groups, pollution prevention grants, and encouragement of voluntary, private efforts.

Regulation and Enforcement

Federal agencies, such as the Council on Environmental Quality (CEQ), EPA, and the Federal Trade Commission (FTC) are shaping regulatory and enforcement actions to promote pollution prevention.

National Environmental Policy Act. NEPA includes among its objectives promotion of efforts to prevent or eliminate damage to the environment. Accordingly, CEQ provides guidance to federal agencies on incorporating pollution prevention into the design and execution of projects. Federal pollution prevention efforts, where appropriate, are a part of Environmental Impact Statements (EIS) and Environmental Assessments (EA). Whether federal agencies manage public lands, issue regulations, or purchase office supplies, the CEQ guidance helps ensure that federal actions and federal funds serve as a catalyst for national efforts to reduce pollution at its source.

Supplemental Environmental Projects. EPA encourages pollution prevention through the inclusion of Supplemental Environmental Projects (SEPs) in settlement agreements resolving violations of environmental statutes. As part of such an agreement, a defendant conducts pollution prevention or other projects that reduce risks to human health and the environment, beyond what is required by law. To date, EPA has negotiated 164 SEPs in settlements under the Emergency Planning and Community Right-to-Know Act, Resource Conservation and Recovery Act (RCRA), Clean Water Act (CWA), Clean Air Act (CAA), and Toxic Substances Control Act (TSCA). Facilities generally commit to spending $1-5 for every penalty dollar reduced as part of the settlement. Annual reductions in toxic chemicals used or released by defendants have ranged from 8,500 pounds to 1.5 million pounds per project. The goal of this EPA program is to encourage SEPs that eliminate or significantly reduce pollutants or decrease natural resources usage, while showing little or no increase in net costs to the offending facility.

Source Reduction Review. The Pollution Prevention Act requires EPA to review its own regulations to determine their potential for source reduction. EPA established the Source Reduction Review Program to ensure early review of key regulations mandated by CAA, CWA, and RCRA. In developing industrial standards, EPA is considering the use of source reduction technologies, along with market-based approaches and command-and-control options, as the basis for regulatory standards.

Guidelines for Environmental Marketing

Consumers can help prevent pollution by considering the environmental impacts of the products they purchase. In July 1992 the Federal Trade Commission, with input from EPA, issued the following national guidelines to address application of section 5 of the Federal Trade Commission Act to environmental advertising and marketing practices:

- Environmental claims must be substantiated by reliable scientific evidence;
- Qualifications and disclosures should be sufficiently clear and prominent on a product to prevent deception;
- Environmental claims should make clear whether they apply to the product, the package, or a component of either;
- Environmental claims should not overstate the environmental attribute or benefit;
- A claim comparing the environmental attributes of one product with those of another should make the bases for the comparison clear and should be substantiated.

The guidelines cover the following environmental claims being made by advertisers for products in the U.S. marketplace:

General Environmental Benefit. Unless substantiated, claims of general benefit, such as "environmentally friendly" or "environmentally safe," should be avoided.

Degradable, Biodegradable, and Photodegradable. Claims should be substantiated by evidence that the product will completely decompose into elements found in nature within a reasonable time after consumers dispose of it in the customary way.

Compostable. Claims should be substantiated by evidence that all materials in the product or package will break down into usable compost, such as soil-conditioning material and mulch, in an appropriate composting program or facility or in a home compost pile or device.

Recyclable. A product or package should not be marketed as recyclable unless it can be collected, separated, or recovered from the solid waste stream for use in the form of raw materials in the manufacture of a new product or package.

Recycled Content. Materials should have been recovered or diverted from the solid waste stream, either during manufacture or after consumer use.

Source Reduction. Claims that a product or package has been reduced or is lower in weight, volume, or toxicity should be qualified to avoid deception about the amount of reduction and the basis for any comparison asserted.

Refillable. Claims should provide for collection and return of the package for refill or for later refill of the package by consumers with a product subsequently sold in another package.

Ozone Safe and Ozone Friendly. A product should not be advertised as ozone safe, ozone friendly, or as not containing CFCs, if the product contains any ozone-depleting chemical.

While the guidelines themselves do not have the force of law, failure on the part of companies to follow them can result in the Federal Trade Commission bringing suit against offending companies. Between July 1991 and July 1992, FTC announced consent agreements in eight such enforcement actions. In three cases, products containing CFCs or other ozone-depleting chemicals claimed to be ozone-friendly. Four cases involved unsubstantiated claims of biodegradability of plastic trash bags and disposable diapers. The eighth case dealt with a manufacturer's improper claim that its product was pesticide-free. The settlements in these cases prevent the companies from using misleading claims in the future.

The Commission is seeking public comments on whether to modify the guidelines at the end of a 3-year period. In the meantime, interested parties may petition FTC to amend the guidelines.

Government-Business Cooperation

The federal government cooperates with private businesses on pollution prevention through a number of initiatives.

President's Commission on Environmental Quality. In cooperation with the President's commission (PCEQ), 11 major corporations have undertaken voluntary demonstration projects at 12 facilities to test the integration of total quality management (TQM) and pollution prevention. Using quality improvement methods to eliminate inefficiencies that waste resources and cause pollution, the project seeks to cut emissions at targeted facilities and save money at the same time. PCEQ is preparing a report, *Total Quality Management: A Framework for Pollution Prevention*, to present quality environmental management (QEM) incentives and barriers, management processes, and measures of success to guide the development of new QEM programs.

Integrated Resource Planning. Under the President's National Energy Strategy, the Department of Energy (DOE) supports Integrated Resource Planning (IRP) by state and federal agencies as well as by individual utility companies. Expanding the traditional electric power planning process that typically considers only utility-generated energy options for meeting electrici-

ty demand, IRP adds conservation, load management, and independent power purchases. By considering alternative sources of energy services, utility companies and utility regulators can avoid the pollution that would result from only building more powerplants and generating more electricity. By the year 2000 DOE estimates that 40 states will have implemented IRP programs, and planning decisions for 90 percent of the nation's generating capacity will be made with pollution prevention in mind.

Green Lights. EPA sponsors this voluntary program to encourage corporations and state and local governments to install energy efficient lighting in their facilities. Participants reduce energy consumption by replacing existing lighting with technology that delivers the same or better quality lighting while saving electricity, preventing pollution, and saving money on electricity bills. By October 1992 a total of 651 facilities had committed 2.9 billion square feet of office space to the program—more office space than exists in New York City, Los Angeles, Chicago, Houston, Dallas, San Francisco, and Washington D.C., combined. Once enrolled, participants survey their facilities to see where lighting efficiency can be improved and commit to making 90 percent of the identified cost-effective lighting upgrades within five years.

In 1992 Green Lights resulted in an average reduction in lighting electricity demand of 53 percent, total energy savings of 100.5 million kilowatt hours, and a $6.8 million reduction in energy bills. These upgrades achieved annual emission reductions of 133.5 million pounds of carbon dioxide, 1.2 million pounds of sulfur dioxide, and 482,000 pounds of nitrogen oxides. When fully implemented, the project has the potential to prevent several thousand times these quantities of air emissions. Green Lights maintains a Hotline number, (202) 775-6650, to provide information on the program.

Energy Star. A major obstacle to marketing energy efficient equipment is the lack of reliable information on whether the equipment will perform as promised. A new EPA product-labeling program identifies proven energy efficient products with a distinctive Energy Star logo. Consumers will find the Energy Star seal of approval on commercial and residential products such as computers, showerheads, and room air conditioners beginning in the summer of 1993.

Golden Carrot. EPA and a consortium of electric utility companies are working on an initiative called the Golden Carrot to overcome another barrier to developing the energy efficiency market—the time lag between development and commercialization of energy efficient products. Participating utilities have established a $30 million prize for the first company to market a nonCFC refrigerator that is at least 25 percent more energy efficient than 1993 standards. By the year 2000 such refrigerators could reduce electricity consumption by 3 billion kilowatt hours per year, saving consumers $240 million on their annual electric bills. The Golden Carrot competition could help the nation implement the U.N. Framework Convention on Climate Change by preventing 600,000 metric tons of carbon emissions each year. It also could help meet U.S. obligations under the Montreal Protocol to phase out CFC production.

Future Golden Carrots could bring to the market high efficiency clothes washers and dryers, water and space heaters, and central air conditioning systems. Golden Carrot also is inspir-

ing other nations to promote energy efficiency. In Thailand, public utilities have developed a Golden Mango program to bring high-efficiency refrigerators to its market.

NICE^3. Short for National Industrial Competitiveness through Efficiency: Energy, Environment, and Economics, NICE^3 is a state grant program jointly administered by EPA, and the departments of Commerce and Energy. Grants support innovative technologies in waste reduction and energy efficiency that can improve industrial competitiveness. In 1991 the following grants helped save energy, reduce hazardous wastes, and generate cost savings.

- **Methanol Recovery.** A grant helped the Peroxygen Chemical Division of FMC Corporation in Texas develop a method to use steam distillation to recover spent methanol from its hydrogen peroxide purification process, thus reducing the facility's energy consumption by 300 billion BTU, its hazardous waste generation by 14.6 million pounds, and its operating costs by $11.9 million per year.
- **Reclaimed Cleaning Water.** A grant helped a PPG Industries facility in Ohio design and install a combined ultrafiltration/reverse osmosis unit to reclaim cleaning water used in the production of water-based primers. The unit will save the company $205,000 per year while reducing hazardous wastes by 3.1 million pounds and cutting energy consumption by 190 billion BTU.
- **Reduced Emissions of Volatile Organic Compounds.** A grant to the Niagara Mohawk Power Corporation and Carrier Corporation in New York helped demonstrate how reducing the emission of volatile organic compounds can lead to energy efficiency improvements. If adopted nationwide, the program has the potential to save 30 trillion BTU and avoid the generation of 126 million pounds of hazardous waste each year.

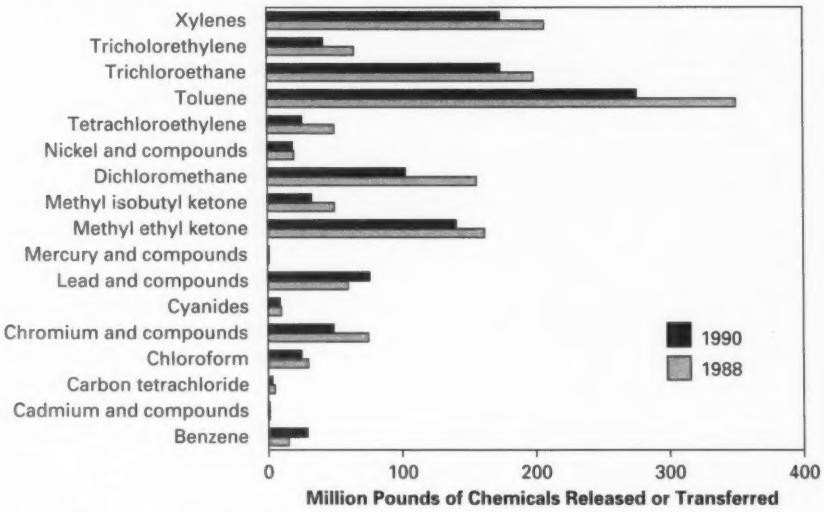
33/50 Program. The EPA 33/50 program derives its name from its goals—a reduction of 33 percent by 1992 and of 50 percent by 1995 in environmental releases and off-site transfers of 17 priority pollutants. The baseline year for reductions is 1988, when releases and transfers of these chemicals totaled 1.4 billion pounds, as measured by the Toxics Release Inventory (TRI). By October 1992 a total of 937 companies had volunteered to reduce their releases and transfers by 347 million pounds—25 percent below the 1988 baseline. See following page.

National Science Foundation Research Grants. In 1992 NSF and the Council for Chemical Research, Inc., initiated a program to fund research aimed at reducing manufacturing pollution at its source by designing new chemical synthesis and processing methods. In 1992 the program funded ten joint university-industry research programs and anticipates rapid expansion in 1993. Research projects seek feedstock substitutions, alternative synthetic and separation procedures, better catalysts, and process modifications to reduce resource and energy consumption and minimize the production of byproducts and wastes. Industrial participation in the design and evaluation of the projects ensures the applicability of research to real-world manufacturing problems and speeds technology transfer from the laboratory to the manufacturing plant.

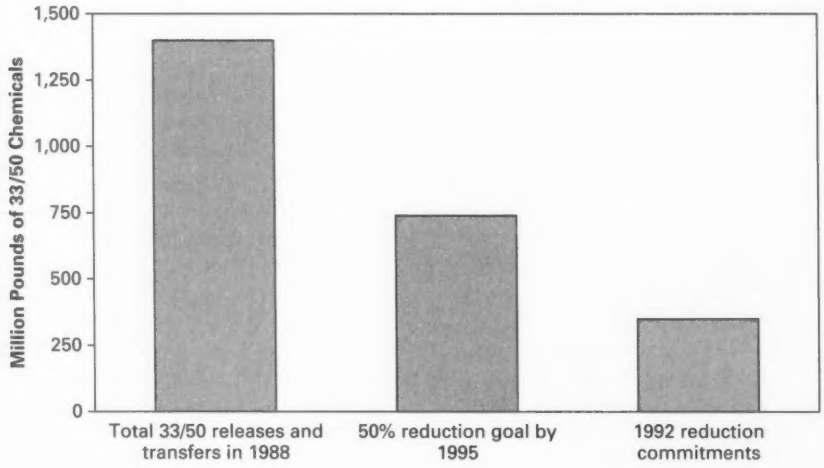
Dye Industry Initiative. EPA and the Ecological and Toxicological Association of Dyestuffs Manufacturers

Chemicals and reduction goals of the EPA 33/50 Program.*

33/50 chemicals in the Toxic Release Inventory.



Reduction goals of the 33/50 program.



* In this voluntary program, industries committed to reduce 33 percent of targeted toxic wastes by 1992; currently, 1,004 companies have committed to reduce 50 percent by 1995.

Source: U.S. Environmental Protection Agency, Office of Toxic Substances, Washington, DC, 1992.

(ETAD) have developed a pollution prevention program for the dye industry. In October 1991 a task force, with representatives from ETAD, individual companies, and EPA, issued a pollution prevention manual for the dye industry. The manual identifies opportunities for pollution prevention and recycling for all operations related to dye manufacturing, from purchasing materials to packaging the product. To monitor progress, ETAD is using a survey that collects information on waste reduction activities in the industry.

Design for the Environment. In 1992 EPA launched Design for the Environment (DFE) to apply pollution prevention principles to the design of chemical processes and products. By disseminating information on the comparative risk and performance of chemicals, DFE helps industries make informed, environmentally responsible design choices. The program includes the following components:

- **Chemical Design Grants Program.** DFE is funding research at six universities to minimize or eliminate toxic substances in the synthesis of chemicals.
- **National Center for Pollution Prevention.** This consortium, located at the University of Michigan, is developing academic curricula on chemical design for use in business, engineering, and natural resources programs.
- **Demonstration Projects.** In the Printing Industry Pilot Project, EPA is bringing together printers, printing trade associations, and chemical and equipment suppliers to investigate alternative chemicals and processes to prevent pollution.
- **Insurance Incentive.** This pilot project is designed to work with the insurance industry to investigate whether rates can be adjusted to reflect the reductions in environmental liability associated with pollution prevention projects.
- **Full Cost Accounting.** As part of the program, EPA is preparing a workshop on how companies can account more accurately for the costs of their polluting activities.

Recycled Products Trade Fair. In June 1992 the Council on Federal Recycling and Procurement Policy hosted a trade fair to increase the use of recycled-content products by the federal government. The theme, "Closing the Loop," stressed that unless materials recovered from the waste stream are turned into products that someone can use, they have not really been recycled. The fair brought together the makers of recycled-content products with one of the country's largest consumers—the federal government. Recycled content product manufacturers demonstrated the availability and quality of their products, while government officials explained the process of selling those products to the government.

Department of Defense Purchasing. As major purchasers and users of hazardous materials, the armed services have the potential to reduce pollution in their operations. In 1992 the Army, Air Force, Navy, and Marines recorded pollution prevention accomplishments in systems acquisition, material substitution, process improvement, and improved material management. For more information, see the Department of Defense section.

Postal Service Initiatives. The pollution prevention program of the U.S. Postal Service includes source reduction and recycling. For a discus-

sion of recycling efforts, see the Federal Facilities Management section.

- **Source Reduction.** Efforts include the replacement of wooden pallets by longer-life, more cost-effective plastic pallets. The cost per trip for plastic pallets is about half that of the wooden models. Changing to a thinner, yet equally strong cardboard for Express Mail packaging has reduced bulk by 15 percent, while also reducing shipping costs, warehousing, and post-consumer costs of disposal. A lighter, more economical Express Mail envelope, with no loss in service, security, or customer confidence, saves 170 tons per year—a 15-percent reduction in bulk. A change to Priority Mail flat-rate envelopes made of a lighter weight, 100-percent recycled (25 percent post-consumer waste) stock saves 251 tons of cardboard annually.
- **Third Class Mail Study.** A 1990 study indicated that 8.2 percent of third-class mail was undeliverable and thrown away. In response, the Postal Service has worked with mailers to improve the quality of their address lists through National Change of Address (NCOA), Address Change Service (ACS), Operation MAIL, and Address List Correction. As a result, bulk business mail has been reduced by 1.4 billion pieces in the last two years.
- **Global Mailstream Study.** The Universal Postal Union accepted a proposal by the U.S. Postal Service to study how postal services worldwide can be leaders in preventing pollution. A workgroup, composed of postal administrations from Sweden, Japan, China, the United States, and the former Soviet Union will survey 175 postal administrations on ways to prevent pollution from materials entering the global mailstream.

Voluntary Initiatives

Through awards programs, the federal government recognizes outstanding voluntary initiatives to prevent pollution. In May 1992 the EPA Administrator's Awards recognized 17 organizations for outstanding achievements in pollution prevention. Winners were selected from 840 applicants, and awards were made in the following categories: environmental, nonprofit, and community organization; small and large business; local governments; state government; federal government; and educational institution. Recipients included the following:

- A Chemical Hazards Prevention Program by Inform, Inc.;
- Green Star Program by the Alaska Center for the Environment;
- A Volatile Organic Compound Reduction Program by Mead Packaging;
- A new single-coat paint developed by the Navy; and
- A pollution prevention planning model developed by the Air Force.

Private Sector Initiatives

Also see Pollution Prevention and related tables and figures in Part II.

A growing number of private-sector organizations, including for-profit and nonprofit groups, recognize the synergy between environmental protection and economic growth. In 1992 this ongoing shift in American culture was evident in new and expanded environmental initiatives.

Conditions and Trends

American businesses are finding that a strong commitment to environmental protection makes good business sense. The Business Council for Sustainable Development—a group of leaders from 48 major international corporations—concluded in its 1992 report, *Changing Course*, that environmental concerns are not just a cost of doing business but potentially a source of competitive advantage. In 1992 many U.S. companies implemented large-scale programs and experiments, formed advisory groups, and revised their strategic plans, recognizing that environmental protection can be good for the bottom line.

Environmental initiatives can benefit businesses in the following ways:

- **Cost Savings.** Companies can prevent pollution and save money by improving efficiency, conserving costly materials, and reducing pollution control costs.
- **Greater Flexibility.** Proactive environmental initiatives allow companies to define problems, set priorities, and undertake solutions. Voluntary initiatives allow companies to reduce future liability risks and influence the development of more practical, efficient, and effective regulations.
- **Competitive Advantage.** Companies are finding that environmental leadership keeps them ahead of firms that merely respond to or comply with current regulations.
- **New Markets.** Environmentally sound products, services, and technologies are spurring consumer demand and commercial opportuni-

ties. According to Department of Commerce estimates, the global market for environmental goods and services is in the range of $200 billion-300 billion per year and rising by 5-10 percent per year, with a growing proportion available to U.S. exporters.

- Increased Performance. Corporate environmental leadership promotes investor confidence, attracts high-caliber employees, reinforces employee commitment, and improves public image and dialogue.

Nonprofit groups can also benefit from the trend by gaining access to decision-makers, helping businesses set priorities, and earning credibility for their technical expertise.

Environmental Partnerships

Many of the benefits to business described above are being achieved through strategic partnerships between some businesses and environmental groups that traditionally viewed each other as antagonists. Partnerships are a growing trend for several reasons. The environmental regulatory process serves a vital function, yet power relationships can influence the outcome, with general social costs ending up secondary to competing interests. In environmental partnerships, interest-based negotiations occur among individuals on the basis of what is best for the community, and solutions emerge that benefit the environment and the economy.

Policies and Programs

Agencies throughout the federal government are working to encourage voluntary private sector initiatives to protect the environment. Some of these programs, such as the Green Lights initiative of the Environmental Protection Agency (EPA) and the Take Pride in America program of the Department of the Interior, are described in other sections of this report.

D. Bohn, The Nature Conservancy.

A public-private partnership preserved Santa Rosa Plateau, a natural grassland ecosystem in southern California.

Financial Benefits of Corporate Environmentalism

Many companies are realizing significant results from their environmental initiatives. A few examples follow.

Recycling CFCs. Film Tec, a subsidiary of the Dow Chemical Company, installed new equipment to recover unused chlorofluorocarbons (CFCs), collect CFC vapors, and process CFCs for reuse. The firm has reduced CFC emissions 87 percent since 1986; production of recovery equipment has tripled; and Dow has saved $1.6 million.

Eliminating Emissions. The AT&T Columbus, Ohio, plant saved $210,000 by implementing changes in processes that eliminated emissions of perchloroethylene.

Reducing Toxics. Chevron saved $10 million in disposal costs and reduced hazardous waste 60 percent in the first three years of its Save Money and Reduce Toxics (SMART) program.

Cutting Disposal Costs. The Ford Assembly Plant in Lorain, Ohio, cut its paint sludge volume by 30 percent and its annual disposal costs by $56,000 in one year.

Reusing Wastes. The International Paper Company expects to save $100 million in disposal expenses between 1988 and 1995 by recycling and reusing manufacturing wastes.

Preventing Pollution. The 3M Pollution Prevention Pays program has resulted in cumulative worldwide savings from 1975 to 1990 of $537 million ($450 million from U.S. operations).

Using Chemical Wastes. A Monsanto plant in Texas found a use for chemical wastes that increased production by 20 percent and reduced 5 million pounds of discharge.

In 1992 the Council on Environmental Quality continued to encourage private sector initiatives. Among these efforts were coordination of the President's Commission on Environmental Quality (PCEQ) and the President's Environment and Conservation Challenge Awards.

President's Commission on Environmental Quality (PCEQ)

Created in 1991 by President Bush, PCEQ provides a new model for environmental action built on voluntary participation, collaboration between different sectors of society, and a commitment to continuous improvement in environmental performance. The Commission consists of 23 members from a cross-section of business and nonprofit organizations, each known for his or her vision and previous accomplishments in environmental affairs.

Unlike many traditional presidential commissions convened to study problems and recommend actions by government, PCEQ is oriented toward private sector action and leadership by example. Over the last 18 months, PCEQ has built a network of over 200 organizations that are participating in demonstration projects, testing new ideas, and sharing information and expertise. The commission has in preparation several reports to the President and the nation that will describe

PCEQ actions. The reports provide a blueprint for additional private sector initiatives and call for changes in government policy to foster and encourage environmental actions.

In 1992 PCEQ sponsored 12 initiatives across the range of environmental issues, described here in alphabetical order:

Biodiversity on Private Lands. This project demonstrates the feasibility of systemically integrating biodiversity conservation techniques into private land management. In consultation with biodiversity experts, several large commercial landowners have undertaken demonstration projects involving more than 60 sites that represent a variety of U.S. landscapes and locations. The project team will publish information materials in 1993.

Business/NGO/Government Forum. Participants in PCEQ initiatives are demonstrating that leaders with diverse perspectives can collaborate on environmental problems. To expand the use of this successful approach, PCEQ is recommending the establishment of a national forum to promote regular collaboration on environment and development issues by businesses, nongovernmental organizations (NGOs), and government agencies.

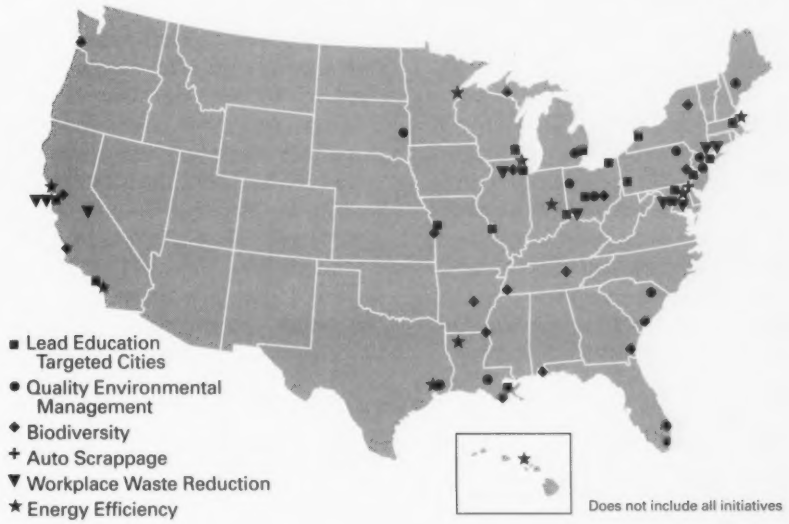
Energy Efficiency. Increased efficiency in the use of electricity and fuel can improve air quality, save money, reduce emissions of greenhouse gases, conserve resources, and strengthen the national economy. PCEQ is encouraging greater energy efficiency on a national scale through a market-based approach. The PCEQ energy team has published a national directory of utility demand-side management programs. The team also has enlisted more than 30 companies in a campaign to make voluntary, cost-effective investments in energy efficiency and to take other steps to trim energy use.

International Environmental Survey. To promote more effective efforts toward environmentally sustainable development worldwide, PCEQ conducted an international survey of nongovernmental organizations in 25 countries. To clarify the concerns and agendas of NGOs and businesses, the commission is comparing results with those of an environmental survey of businesses worldwide, conducted in 1991 by a private group.

Lead and Child Health. U.S. public health officials have found that lead poisoning from historic uses of lead is the foremost preventable environmental health threat to children in the United States. In cooperation with federal agencies, PCEQ has undertaken a media-based educational campaign directed at parents of young children. The campaign will identify sources of lead poisoning, harmful effects, and simple, effective ways to reduce exposure. It also will promote a federal telephone hotline and information clearinghouse, mandated for EPA implementation by the 1992 Housing Bill.

Promoting Partnerships. In 1992 PCEQ designed two projects to study and promote environmental partnerships. One project team sponsored case studies, analyses, and a workshop attended by grassroots leaders to determine what conditions make natural resource conservation partnerships successful. The other team studied how partnerships among businesses, NGOs, and governments in the United States and other countries contribute to more effective environmental management and government policies. Both teams

PCEQ projects.



Source: President's Commission on Environmental Quality, *PCEQ Newsletter*, September 1992; and updates.

prepared reports identifying methods and issues for further collaborative action.

Quality Environmental Management. This initiative epitomizes the entire PCEQ effort. Eleven major corporations are conducting voluntary demonstration projects at 12 facilities to apply the Total Quality Management (TQM) philosophy to the task of pollution prevention. Using quality improvement methods to eliminate inefficiencies that waste resources and cause pollution, this project is cutting emissions at targeted facilities and saving money at the same time. Goals include exploring the TQM/pollution prevention process, devising credible measures of progress, and identifying incentives or barriers to success. The project team is preparing a report for publication in 1993 entitled *Total Quality Management: A Framework for Pollution Prevention.*

Reducing Vehicle Emissions. PCEQ is demonstrating the viability of the "cash for clunkers" concept—generating air emission credits through accelerated retirement of older, heavily polluting automobiles. The commission is augmenting an existing cash-for-clunkers project involving a PCEQ member company in Delaware by devising a method for precise quantification of emission reductions. The project team is analyzing the cost-effectiveness of such programs for promotion among businesses and regulatory agencies.

U.S. Environmental Training Institute (USETI). With PCEQ support, the nonprofit U.S. Environmental Training Institute was founded in 1991 to train participants from developing

countries at U.S. companies and institutions, thus facilitating the transfer of cleaner technologies. Eight corporate and two nonprofit PCEQ members are assisting USETI by sponsoring site visits, conducting training classes, and providing scholarships. Two PCEQ participant companies are working with USETI to conduct an industrial technology cooperative project in the Republic of Indonesia.

Water Education and Conservation. PCEQ has joined an ongoing, long-term project of the National Geographic Society to raise national awareness of threats to freshwater and actions needed to assure availability and quality of this resource in the future. Commission members are creating partnerships to enhance water education and conservation, share expertise on water-related technologies, promote water conservation and cleanup projects at industrial facilities, and encourage conservation by the general public.

Workplace Waste Reduction. This project has produced a comprehensive solid-waste reduction guide for an audience that ranges from corporate offices to small businesses. The guide

PCEQ

PRESIDENT'S COMMISSION ON ENVIRONMENTAL QUALITY

Member	Affiliation	Location
Edwin Artzt	Procter & Gamble Company	Cincinnati, OH
Riley Bechtel	Bechtel Group, Inc.	San Francisco, CA
Dean Buntrock	Waste Management, Inc.	Oak Brook, IL
Richard Clark	Pacific Gas and Electric Company	San Francisco, CA
Derrick Crandall	American Recreation Coalition	Washington, DC
Michael Deland (Chairman)	Council on Environmental Quality	Washington, DC
Kenneth Derr	Chevron Corporation	San Francisco, CA
Robert Fri	Resources for the Future	Washington, DC
Katherine Fuller	World Wildlife Fund	Washington, DC
John Georges	International Paper Company	Purchase, NY
Paul Gray	Massachusetts Institute of Technology	Cambridge, MA
Gilbert Grosvenor	National Geographic Society	Washington, DC
Allen Jacobson	3M Company	St. Paul, MN
Fred Krupp	Environmental Defense Fund	New York, NY
Kenneth Lay	Enron Corp.	Houston, TX
Richard Mayer	Kraft Foods North America	Glenview, IL
Patrick Noonan	Conservation Fund	Arlington, VA
H.A. Poling	Ford Motor Company	Dearborn, MI
F. Popoff	The Dow Chemical Company	Midland, MI
William Ruckelshaus (Vice-chair)	Browning-Ferris Industries, Inc.	Houston, TX
Adele Simmons	John D. and Catherine T. MacArthur Foundation	Chicago, IL
Roy Vagelos	Merck & Co., Inc.	Rahway, NJ
John Welch, Jr.	General Electric Company	Fairfield, CT

Source: CEQ, 1991.

Unocal Corporation.

As part of a project to remove older, high-emission cars from the highways, this "clunker" is being crushed.

An Environmental Collaboration: General Motors and the Environmental Defense Fund

A giant automaker and a nonprofit environmental group have teamed up to develop innovative strategies for reducing air pollution. The two organizations are focusing on expanding market-based incentives for businesses to find cost-effective ways to clean up pollution. After examining GM environmental programs, EDF will assess the most cost-effective actions the company can take. The two organizations are working on an accelerated auto-scrappage program to take older, heavily polluting cars off the road in California.

describes how to inventory materials use and waste generation to encourage wider application of waste-reduction practices throughout the business and retail sectors.

President's Environment and Conservation Challenge Awards

In November 1992, for the second year, President Bush bestowed medals for excellence in the field of environmental conservation, just as Presidents long have honored Americans for excellence in the arts, humanities, sciences, and world affairs. The presidential medals for environmental achievement represent the nation's highest honor in this field. The President's Environment and Conservation Challenge Awards recognize citizens and organizations for outstanding contributions to the environmental quality of the nation.

In 1992 an independent selection committee judged applications and selected 9 presidential medal recipients and 13 citation recipients in the following categories:

- Environmental Quality Management,

Medal and citation recipients in the President's Environment and Conservation Challenge Awards Program, 1992.

Category	Medal	Citation
Partnership	Florida Save Our Everglades Program; State of Florida and partners, Tallahassee, FL	Compressed Natural Gas Vehicle Conversion Projects; New Mexico Department of Energy, Minerals, and Natural Resources, Santa Fe, NM, and the Gas Company of New Mexico, Albuquerque, NM
	Think Earth Environmental Education Program; Southern California "Think Earth" Environmental Education Consortium, Lakewood, CA	Santa Rosa Plateau Agreement; Metropolitan Water District of Southern California and partners, Los Angeles, CA
	Energy Conservation Collaborative Effort; New England Electric System, Westboro, MA, and the Conservation Law Foundation of New England, Boston, MA	Keep Texas Beautiful; Keep Texas Beautiful, Inc., Austin, TX
		Partnership for Wetlands Conservation; The Dow Chemical Company and partners, Midland, MI
Environmental Quality Management	Environmental Management and Conservation Programs; IBM Corporation, Stamford, CT	Corporate Environmental Policies; 3COM Corporation, Santa Clara, CA
	Boston Park Plaza Hotel and Towers Environmental Action Program; Saunders Hotels Group, Inc., Boston, MA	

- Partnership,
- Innovation, and
- Education and Communication.

Descriptions of the nine medal recipients follow.

Save Our Everglades. This program to preserve and restore Florida's unique wetlands ecosystem includes restoration of the Kissimmee River and protection of Lake Okeechobee, state Water Conservation Areas, Big Cypress Swamp, the Florida panther, and other endangered wildlife. The program has acquired 290,000 acres of land and constructed 36 wildlife highway crossings and bridges to protect endangered species and improve hydrology. It also helped pass landmark federal and state legislation. Partners include the State of Florida, the 22 conservation groups that form the Everglades Coalition, the U.S. Army Corps of Engineers, the National

Medal and citation recipients (continued).

Category	Medal	Citation
Innovation	CFC Solvent Phase Out; Northern Telecom, Inc., Nashville, TN	Georgia No-Tillage Assistance Program; Georgia Office of Energy Resources, Atlanta, GA
	South Coast Recycled Auto Project (SCRAP); Unocal Corporation, Los Angeles, CA	Jefferson North Project; Chrysler Corporation, Detroit, MI
		"Great Lakes Recycle" Program; Council of Great Lakes Governors, Chicago, IL
		Innovative Source Reduction; Procter & Gamble Company, Cincinnati, OH
Education and Communications	People for Community Recovery; People for Community Recovery, Inc., Chicago, IL	Save Our Streams; Save Our Streams, Glen Burnie, MD
	Environmental Education Program; Chesapeake Bay Foundation, Annapolis, MD	Earth Matters; Hannaford Brothers Co., Scarborough, ME
		Chesapeake Bay License Plate Program; State of Maryland, Annapolis, MD
		Project CENTS; Tennessee Conservation League, Nashville, TN

Source: CEQ, 1992.

Park Service, and the U.S. Fish and Wildlife Service.

Think Earth. The Southern California Think Earth Environmental Education Consortium, composed of 13 organizations, developed and distributes an elementary school curriculum to teach children to conserve natural resources, reduce waste, and minimize pollution. Helping to reach one million students nationwide are the following consortium partners: Atlantic Richfield Company, City of Los Angeles, Education and Development Specialists, GTE California, Los Angeles Department of Water and Power, Metropolitan Water District of Southern California, Orange County Sanitation Districts, Sanitation Districts of Los Angeles County, South Coast Air Quality Management District, Southern California Edison, The Gas Company, Ventura County Air Pollu-

tion Control District, and the Ventura Regional Sanitation District.

Energy Conservation Collaboration. The once unlikely union of an electric utility, the New England Electric System of Westboro, Massachusetts, and an environmental group, the Conservation Law Foundation of New England, has resulted in two major achievements: development of a successful energy conservation program and regulatory approval for a utility earnings incentive. The partners designed a new facility, known as the "powerplant that conservation built." The design has reduced air pollutants and the need for new capacity, while saving money for consumers and stockholders.

IBM Environmental Management and Conservation. IBM Corporation has demonstrated that a large company can institutionalize and practice environmental protection and conservation through sound policy practices, executive leadership, and employee commitment. The company's record of accomplishments results from meeting or exceeding government regulations and, where none exist, from setting and adhering to its own stringent standards.

Boston Park Plaza Environmental Action. The Boston Park Plaza Hotel and Towers has undertaken an environmental campaign with 85 initiatives involving all departments of the hotel. The environmental actions of this family-owned and operated landmark property demonstrate that the competitive hospitality service industry can make changes that benefit the environment, while maintaining quality service and standards.

CFC Solvent Phaseout. In 1988 Northern Telecom, Inc., pledged and attained the complete phaseout of CFC-113 solvents from its 42 manufacturing and research operations worldwide. By the end of 1991 Northern Telecom, the first global telecommunications company to make such a pledge, had eliminated the use of these solvents in all of its operations. The phaseout reduced CFC solvent emissions into the atmosphere from 1,000 tons per year to zero in three years.

South Coast Recycled Auto Project (SCRAP). The Unocal Corporation sponsored SCRAP, an unprecedented effort to improve air quality in the Los Angeles Basin by scrapping heavily polluting, pre-1971 cars. In four months, the company purchased and crushed for recycling 8,376 old cars. SCRAP reduced air pollutants by 13 million pounds per year at a cost of 50 cents per pound.

People for Community Recovery. A grassroots environmental education and advocacy organization, People for Community Recovery, Inc., serves a predominantly low-income, African-American community in Chicago. PCR assesses environmental hazards in the community and mobilizes constituents to alleviate the hazards. Hazel Johnson, the group's founder and executive director, is a national leader in the grassroots environmental movement.

Chesapeake Bay Environmental Education. The Outdoor Environmental Education Program of the Chesapeake Bay Foundation provides field instruction in estuarine issues to students, teachers, and other people throughout the Bay watershed. The goal is to create a constituency that not only values and understands the bay but works to restore it. Hands-on water activities involve canoes, rowboats, skipjacks, powerboats, and work on a model low-input farm operated by the Foundation.

Public Lands

Also see Biodiversity, Forestry, and related tables and figures in Part II.

The U.S. government manages natural resources on federal lands to provide for the needs of present and future generations. A policy of sustainable multiple use provides range, timber, minerals, watersheds, fish and wildlife habitat, wilderness, and recreation, while maintaining scenic and cultural values. Protected from unregulated development, public lands support resource development that sustains the long-term productivity of soils, waters, plants, and animals. Some federal lands and natural resources are managed for special uses, such as parks, military training, grazing, endangered species, and outdoor recreation. For example, on lands managed by the departments of the Interior and Agriculture, 95 million acres (15 percent) are designated wilderness.

Conditions and Trends

In 1992 public land management reflected the nation's demand for a balance between environmental and economic values. Federal land managers worked to meet the public desire to protect natural landscapes while providing resources for economic growth. Increased populations in the western states are influencing federal land management, which no longer occurs in isolated settings but in close proximity to residential areas. Today federal land managers coordinate actions closely with states, municipalities, and the private sector.

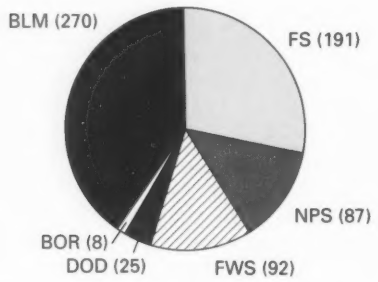
Policies and Programs

In 1992 federal land agencies continued to take a leadership role in defining new ways to achieve effective stewardship of natural resources.

Public Rangelands

Together the Bureau of Land Management (BLM) and the USDA Forest Service manage a quarter of a billion acres of land available for use by livestock. Grazing fees for federal pastures remain a controversial issue.

Protected federal lands, in million acres.



Note: BLM = Bureau of Land Management, Department of the Interior
FS = Forest Service, Department of Agriculture
NPS = National Park Service, Department of the Interior
FWS = Fish and Wildlife Service, Department of the Interior
DOD = Department of Defense
BOR = Bureau of Reclamation, Department of the Interior

Source: CEQ, 1992.

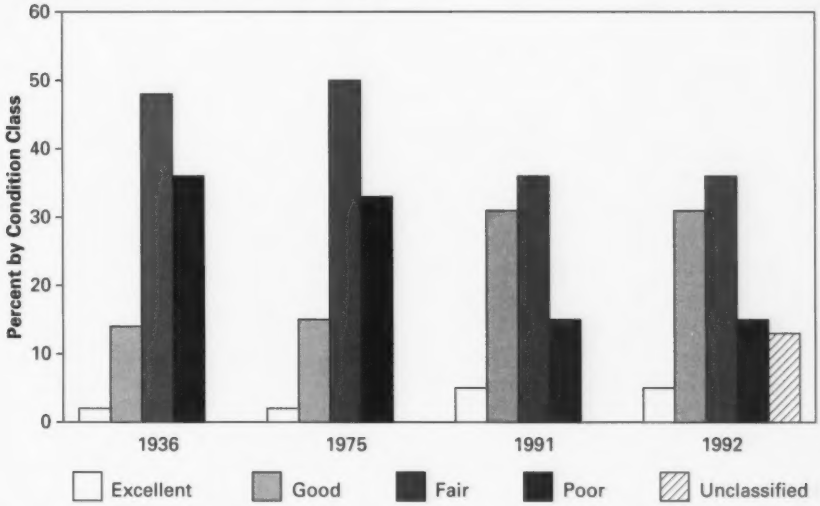
Bureau of Land Management. BLM manages 170 million acres of rangelands, some in poor condition because of past livestock overgrazing, agricultural and commercial misuse, and off-road vehicle abuse. Fifty years ago, a third of BLM rangelands were in poor condition with only 16 percent in good to excellent condition. In 1991 rangelands in poor condition were down by half, while rangelands in good to excellent condition had increased to 36 percent, with an overall 87 percent in stable or improving condition. BLM is committed to increasing rangelands in good to excellent condition to 40 percent and to reducing those in poor condition to 10 percent. The bureau also has set a goal for establishing environmental balance by 1997 on 75 percent of riparian-wetlands areas, which can be impacted by grazing. For more information, see the Wetlands section.

BLM improves rangeland conditions by means of grazing management systems, protective fencing, water development in the uplands, plantings, and reseeding. Examples follow.

- **Incentive-Based Grazing Fees.** Grazing fees for the use of federal lands are a contentious issue addressed annually by legislation. In 1992 the fee was $1.92 per animal-unit month (one cow and calf per month). In 1991 BLM collected $19 million in grazing fees. A BLM task force has developed a proposal that would give ranchers an incentive to improve leased federal lands. Incentive-based grazing fees could improve range management without significantly increasing the program budget. Although participation in incentive programs would be optional, ranchers who chose not to adopt sound management practices that maintain or improve rangeland would pay significantly higher fees.
- **Coordinated Interdisciplinary Resource Monitoring (CRIM).** BLM is consolidating rangeland monitoring in CRIM, a unified data-collection effort for all of its programs. CRIM provides the information needed to evaluate management and to select best management practices.
- **Desired Plant Community (DPC).** A vegetation management strategy called DPC achieves plant communities that best meet the overall needs of the public, wildlife, and livestock. Such communities, at the same time, protect water, soil, vegetation, and air.

Forest Service. Of the 191 million acres managed by the USDA Forest Service, 100 million acres are available for use by domestic livestock. A new

Condition of public domain rangelands.



Note: 13 percent of public domain rangelands were unclassified in 1992.

Source: See Part II, Table 56.

Change-on-the-Range philosophy advocates ecology-based range management to accomplish resource stewardship and provide healthy rangeland ecosystems. In 1992 the Forest Service implemented a new information reporting system to measure the health of rangelands. A sampling of other projects follows.

- **Grazing Fees.** The Forest Service administered 9,798 grazing allotments in 33 states in 1992. Grazing fees varied from $1.92 to $3.92 per animal-unit month. Fees collected from public grazing on national forests—excluding national grasslands—totaled $9.7 million in 1991 and $8.8 million in 1992.
- **Video Documentary.** In 1992 the Forest Service and the American Farm Bureau produced and distributed a video documentary featuring on-the-ground ecological range management.
- **Noxious Weeds.** A 1992 Noxious Weed Workshop, designed for range managers, had as cosponsors: the Forest Service, BLM, Western Weed Coordinating Committee, Intermountain Noxious Weed Advisory Council, Nevada State Department of Agriculture, Montana State Department of Agriculture, and Montana Weed Control Association.
- **Livestock and Big Game.** A 1992 Livestock-Big Game Workshop addressed conflicts that can arise when managing livestock and big game species on national forests and neighboring private lands. Cosponsors were the Forest Service, National Cattlemen's Association, Public Lands Council, International Association of Fish and Wildlife Agencies, and the Wildlife Management Institute.

Energy and Minerals

In fiscal 1991 and 1992 onshore and offshore energy minerals leases provided $4.3 billion in revenue to the

U.S. Treasury, the Historic Preservation Fund, the Land and Water Conservation Fund, Indian tribes, and the states. Leasable minerals include oil and gas, coal, geothermal energy, phosphate, and, to a limited extent, hardrock minerals. BLM administers federal lands and interests that contain the nation's onshore mineral resources, and the Minerals Management Service manages the mineral leasing and development on the outer continental shelf.

Bureau of Land Management. BLM fosters development of onshore minerals to achieve sustained yield, multiple use, and conservation of natural resources. Federal lands managed by a number of agencies and subject to surface and subsurface mineral development total 732 million acres, of which 272 million acres are surface and subsurface rights on BLM lands. The remaining 460 million acres are acquired lands, lands that have been patented with minerals reserved to the United States, and public lands on which minerals are administered jointly by BLM and other agencies, such as the National Park Service and the Forest Service.

In fiscal 1991 non-energy leasable mineral development on federal lands provided $83 million in lease revenue. Of the $31 billion contributed to the gross national product by nonfuel minerals produced in the United States, federal lands in the West figured prominently. These lands hold a large volume of potentially minable resources—gold, copper, and other hardrock minerals. Policy debate continues over the environmental and economic aspects of hardrock mining.

Minerals Management Service. The nation's outer continental shelf (OCS) encompasses 1.2 billion acres. A portion of revenues derived from offshore oil and gas leases are designated to help preserve marine habitats, including biodiversity and historic and cultural resources. The OCS Program provides 80 percent of revenues credited to the Land and Water Conservation Fund (L&WCF). OCS revenues supplied the fund with $843.8 million in fiscal 1990; $885 million in fiscal 1991; and $888 million in fiscal 1992.

Watchable Wildlife

Federal land agencies have formed Watchable Wildlife partnerships with groups such as Defenders of Wildlife, National Audubon Society, National Wildlife Federation, and the Izaac Walton League. Begun in 1988 the program is a nationwide effort to increase wildlife viewing opportunities, provide information on the needs of wildlife, and promote wildlife conservation. BLM maintains 159 viewing sites in 11 western states, and the Forest Service maintains 165 viewing areas with plans for an additional 220. Accomplishments for 1992 included the following:

- **Viewing Areas.** In 1992 a National Watchable Wildlife Conference gathered and disseminated data on tools for creating viewing areas nationwide. In Colorado, BLM, the Forest Service, Colorado Division of Wildlife, Bighorn Sheep Society, and the City of Georgetown established the Big Horn Sheep Viewing Area, 30 miles west of Denver.
- **Viewing Guides.** Watchable Wildlife cooperators have published 12 state viewing guides and are planning guides for most of the other states. In 1992 the National Park Service, National Park Foundation, and National Fish and Wildlife Foundation prepared a viewing guide for

Mining on the National Forests

The Forest Service manages lands with mineral deposits to ensure that surface development is conducted in an environmentally acceptable manner and that lands are restored to a productive condition. The mining industry assists by funding environmental studies and mitigation, such as fish, wildlife, and recreation enhancement projects. Estimated industry contributions for environmental studies in 1992 were $5 million. The Forest Service minerals program covers both leasable and locatable minerals. In 1992 a total of 12 million acres were under lease, mostly for oil and gas. The Forest Service reviews proposals for leasing, informs BLM which lands can be made available, and approves surface-use operating and reclamation plans after leases are issued to ensure that mining is conducted in an environmentally sensitive manner. The Forest Service reports the following mining statistics for 1992:

- Production of 12 million barrels of oil and 210 billion cubic feet of gas from 2,300 wells on 12 million acres of leased land, disturbing only 11,500 acres (0.1 percent) of the land leased.
- Opening, on the Inyo National Forest in California, of the first geothermal powerplant on National Forest System (NFS) lands.
- Decline in land leased for oil and gas, from 35 million acres in 1983 to 12 million acres in 1992, reflecting the affect of economic conditions on the industry.
- Production from the largest surface coal mine in the world, a mine on NFS lands in Wyoming, of 3 percent of all coal mined in the nation.
- Over 5.5 million tons of phosphates, with a market value of $137.5 million, produced from leases on NFS lands in Idaho.

Locatable minerals, available for development under the Mining Law of 1872, include gold, silver, copper, zinc, and other minerals. The Forest Service regulates locatable mineral operations to mitigate environmental effects to surface resources and to ensure reclamation. Producing mines total 1,200 out of 500,000 mining claims on 10 million acres of NFS lands, primarily in the West. Only 44,000 acres (0.4 percent of total land under claim) are disturbed as a result of ongoing locatable mineral operations, while 100,000 acres are in various stages of reclamation.

Watchable Wildlife in the National Parks, and the Forest Service launched a similar program, Eyes on Wildlife, for the National Forest System.

L. Kline.

The Watchable Wildlife Program features bighorn sheep in their natural habitat at a viewing area west of Denver.

Recreational Fisheries

In May 1992 the Forest Service and BLM cosponsored a meeting of government fisheries managers to promote a joint policy to improve the quality and quantity of recreational fishing on public lands. A sampling of projects follows.

Fish and Wildlife 2000. Since 1985 BLM has received $11.8 million in federal appropriations, matched by $18 million from private sources, to complete 1,200 wildlife and fisheries projects. In 1992 BLM issued a comprehensive plan for managing its wildlife and fisheries resources.

California Water 2002. As part of its environmental program, the Bureau of Reclamation sponsors the following initiatives in California:

- Contracting with the state to purchase and install salmon spawning gravels in the upper Sacramento River;
- Improving the water supply for the Nimbus Fish Hatchery;
- Contracting for a firm water supply to wildlife refuges in the Central Valley; and
- Initiating a demonstration cost-sharing program with nonfederal diverters to remedy the fish-screen effects of pump and direct-water diversion facilities on the Sacramento and San Joaquin rivers and in the Delta.

Pathway to Fishing. In 1992 five federal agencies and two private groups signed a memorandum of understanding to work together to advance angler skills, ethics, and stewardship of fisheries resources on federal lands and waters. Cooperating in the effort are the USDA Forest Service; four DOI agencies—Bureau of Reclamation, Fish and Wildlife Service, National Park Service, and Bureau of Land Management; Berkley, Inc.; and In-Fishermen, Inc. The cooperators have produced an instructional kit called *Pathways to Fishing* that introduces the public to fishing, fish biology, and aquatic ecology. Kits are available from the U.S. Government Printing Office.

Fish and Wildlife Habitats

The Fish and Wildlife Service manages 92 million acres of national wildlife refuges, administers the Endangered Species Act, provides consultations on water development and water quality under the Fish and Wildlife Coordination Act and section 404 of the Clean Water Act, operates fish hatcheries, and provides grants to states under the Federal Aid in Sport Fish Restoration and Federal Aid in Wildlife Restoration acts. FWS is conducting a management review of the National

Wildlife Refuge System to meet the nation's needs and interests through 2003, the hundredth anniversary of America's first national wildlife refuge. Refuges 2003, a combined management plan and environmental impact statement, will chart the course of the system for the next decade, considering facility and land needs for an increasing population. To encourage public involvement, FWS held 31 meetings around the country and received thousands of public comments.

Celebrate Wildflowers

In 1992 the Forest Service organized Celebrate Wildflowers, an annual, national event to emphasize wildflower appreciation by agency personnel and the public. Underscoring the event is an intensified effort by the Forest Service to inventory rare plants and implement conservation and recovery strategies. This objective is reflected in the number of Forest Service botanists, up from 32 in 1989 to 104 in 1992.

America's Great Outdoors

The President's recreation initiative, America's Great Outdoors, promotes interpretation and education, improved facilities, and acquisition of new recreational lands.

Forest Service. The national forests are the most visited federal lands, with 597.6 million visits per year. In 1992 the Forest Service improved recreational access for visitors, including those with disabilities. The agency expanded interpretive programs for cultural resources and joined interagency partnerships to encourage domestic and international tourism on federal lands. A visitor day equals 12 visitor hours by one or more persons, and in 1992 national forests and grasslands recorded 279 million recreation visitor days, a 6-percent increase over 1990.

National Park Service. In August 1992 President Bush signed a law establishing the Marsh-Billings National Historical Park, the first national park in Vermont. The 550-acre hillside site includes a mansion that was the boyhood home of George Perkins Marsh, who in 1864 wrote *Man and Nature*, a book that inspired the early conservation movement in America.

In 1992 land acquisition for national parks continued, but acquisition alone cannot solve seasonal or site-specific crowding; Yellowstone and Yosemite likely will remain among the nation's favorites, with summer months the most popular visitation times. In 1991 the 361 units of the National Park System recorded 268 million recreation visits, up from 154 million visits to 284 units in 1971. Although entrance to most national parks is not subject to specified capacity limits, some rivers and backcountry areas are restricted to permit holders to avoid overcrowding and natural resource degradation. The National Park Service, in conjunction with public and private organizations, has introduced measures to minimize traffic congestion, including the operation of visitor transportation systems in 12 park areas. Private concessionaires and others outside the parks also provide transportation services for visitors.

Private Concessions on Public Lands. In 1992 to improve management of the private concerns that operate concessions such as hotels, restaurants, and ski resorts on public lands, a Concessions Management Task Force, with members from DOI land management agencies, the USDA Forest Service, and the Army Corps of Engineers, issued a draft report. The

R. Frear.

Yosemite National Park, one of the nation's favorites, provides wildlife habitat and recreational opportunities.

task force recommended maintaining financial consistency among agencies, increasing competition by setting appropriate fees and durations of agreements, and integrating concessions management into federal planning.

Wilderness

Since 1964 the Congress has set aside 95 million acres of wilderness in 548 units of the National Wilderness Preservation System, largely by designating existing roadless areas on national forests and Department of the Interior lands, rather than by adding new lands to the federal estate.

Bureau of Land Management. In 1992 BLM completed a 15-year wilderness review mandated by the Federal Land Policy and Management Act of 1976. The review covered 26 million acres of lands in 750 wilderness study areas in nine western states. In response, the secretary of the Interior recommended for wilderness designation 330 units of BLM lands in the nine western states for a total of 10 million acres, and the President transmitted the following recommendations to the Congress:

- **California,** 62 wilderness areas with 2.3 million acres;
- **Idaho,** 27 wilderness areas with 1 million acres;
- **Nevada,** 52 wilderness areas with 1.9 million acres;
- **New Mexico,** 23 wilderness areas with .5 million acres;
- **Oregon,** 49 wilderness areas with 1.3 million acres; and
- **Utah,** 69 wilderness areas with 1.9 million acres.

Forest Service. The USDA Forest Service manages 33.6 million acres of wilderness in 382 units. In December 1991 the President signed the Chattahoochee Forest Protection Act, adding 25,840 acres of national forests in Georgia to the National Wilderness Preserva-

tion System. In June 1992 the President signed the Los Padres Condor Range and River Protection Act, adding 400,400 acres of national forests in California to the system. The Congress considered but did not pass legislation that would have created another 1.8 million acres of wilderness.

Wild and Scenic Rivers

The National Wild and Scenic River System consists of 151 designated rivers with a total of 10,410 protected river miles. The Forest Service manages 96 of these rivers with a total of 4,316 miles, and BLM manages 32 rivers in five states for 1,991 miles. In fiscal 1992 Congress designated 26 new rivers on national forests for a total of 914 miles in the following states:

- **Michigan,** 14 rivers on the Hiawatha, Ottawa, and Huron-Manistee national forests;
- **Arkansas,** 8 rivers on the Ozark and Ouachita national forests;
- **California,** 3 coastal streams on the Los Padres National Forest; and
- **Pennsylvania,** 85 miles of the Allegheny River on the Allegheny National Forest.

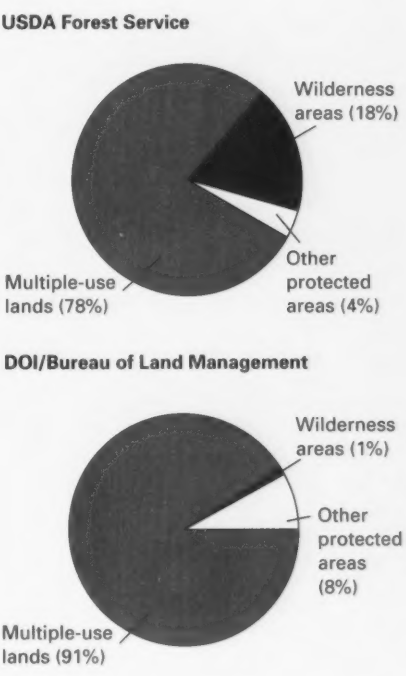
Congress considered but did not pass bills that would have added 112 miles of the lower Salmon River in Idaho, along with sections of the Merced River in California, the Rio Grande in New Mexico, and the Black Canyon of the Gunnison River in Colorado.

Special Recreation Areas

The National Forest System contains 42 congressionally designated recreation areas, encompassing 7 million acres and including 18 national recreation areas, 5 national scenic areas, 4 national monuments, and 15 other recreation areas. In 1992 the Congress added the following lands on the Chattahoochee National Forest in Georgia:

- **Coosa Bald National Scenic Area,** a 7,100-acre scenic area that features the southern Appalachian "bald" vegetative type;
- **Springer Mountain National Recreation Area,** a 23,330-acre recreation area that marks the southern terminus of the Appalachian Trail.

Special uses of Forest Service and Bureau of Land Management lands.



Source: See Part II, Table 73.

America the Beautiful

The President's America the Beautiful (ATB) initiative calls for enhanced recreational opportunities on public

lands. After revitalizing the Land and Water Conservation Fund (L&WCF) as a mechanism for acquiring new recreational lands, the President proposed the purchase of 174,991 acres of special land in 25 states. L&WCF grants funded state and local government acquisitions of parklands and development of outdoor recreation facilities. From its inception in 1965 through 1991, the L&WCF assisted 36,000 projects with $5.5 million; in fiscal 1992 alone, the fund awarded 250 grants totaling $15 million for basic recreation development and 35 grants for acquisition of 8,493 acres of park and open-space lands. ATB has initiated cost-sharing partnerships with states, local governments, and private entities to protect and preserve natural and cultural resources. Examples follow.

Federal Land Acquisition. As of September 1992 the Forest Service had invested $107.5 million in acquiring 166,781 acres of new recreational lands. In fiscal 1992 BLM acquired 189,426 acres of land for protection and recreation, FWS acquired 89,750 acres, and NPS acquired 153,675 acres for a total of 432,851 acres at a cost of $229 million, including the following:

- **Balcones Canyonland National Wildlife Refuge.** This Austin, Texas, refuge provides habitat for seven federally listed endangered species and other rare and potentially threatened species, including the black-capped vireo and the golden-cheeked warbler.
- **Fox River Trail.** After 11 years of efforts by 11 local jurisdictions and $3 million in seven acquisition and development grants, the Fox River Trail in suburban Chicago is now a 70-mile long scenic, riverside path.
- **Pompey's Pillar.** In 1992 BLM acquired a 366-acre landmark property on the Lewis and Clark National Historic Trail in Montana. The site features a large rock outcropping that bears the nation's only physical evidence of the Lewis and Clark Expedition—the carved signature of Captain William Clark. The acquisition also includes 200 acres of wetlands.
- **Stillwater National Wildlife Refuge.** This refuge is a staging area for spring and fall migrations of shorebirds, swans, geese, and bald eagles and a duck breeding site. To acquire additional wetlands and to dilute elevated levels of harmful trace metals in the water, the Fish and Wildlife Service, The Nature Conservancy, and the State of Nevada signed a cooperative agreement to purchase water rights and land from willing sellers to sustain 25,000 acres of wetlands habitat. In 1992 FWS prepared a draft environmental impact statement for acquiring water for wetlands and initiated socio-economic and hydrological studies.

Legacy '99 Corrective Actions. DOI is improving the infrastructure on 450 million acres of national parks, wildlife refuges, and other public lands. The goal is to clean up hazardous materials, increase maintenance, rehabilitate facilities, and inspect 383 dams managed by DOI. In 1992 the dam safety program recorded 194 inspections with corrective actions taken on 12 dams. BLM also completed the first-phase assessment of 47 sites potentially contaminated by hazardous materials and conducted a follow-up study on a classified high-risk site to determine the best method of cleanup.

Recreation and Resource Protection. BLM sponsored 330 challenge cost-share projects to protect natural

resources at recreational sites, and the Fish and Wildlife Service sponsored 211, including the following:

- **Byways System.** Since its inception in 1989, the National Byways System has established 50 backcountry byways—roads that extend through remote scenic corridors—with 2,450 miles in 11 states. BLM and private organizations such as Farmers Insurance and American Isuzu fund interpretive kiosks at entry points and cooperate on improvement and maintenance.
- **Off-Highway Vehicle Project.** BLM signed a memorandum of understanding with the Motorcycle Industry Council and the Specialty Vehicle Institute of America to protect public lands by promoting safe and responsible off-highway vehicle (OHV) recreation. The private groups, which serve as a clearinghouse for resource information and as a link between BLM and riding clubs, have published *Right Rider*, a series of four brochures for the general public. BLM provides expertise on OHV management and involves riders in planning, developing, and maintaining trails.

Partnerships

Partnerships between public and private agencies maximize the effectiveness of federal funds and encourage private sector involvement in preserving natural and cultural resources. Independent cost-sharing grant programs or in-kind grants from private individuals, groups, or organizations support public land management.

Habitat Improvement. The Forest Service administers a Challenge Cost-Share Program, which has increased from 57 partnerships in 1986

Protecting American Battlefields

To promote public stewardship of historic battlefields, the American Battlefield Protection Program, a public-private partnership begun in 1990, identifies sites in critical need of protection.

- **Civil War Legacy 2000.** The Civil War Trust leads a fundraising campaign to raise $200 million by the year 2000 to assist federal, state, local, and private efforts to acquire and protect historic battlefields.
- **Shenandoah Valley Study.** The National Park Service completed a study of 15 battlefields in the Shenandoah Valley of Virginia in response to the Civil War Sites Study Act of 1990. The NPS Battlefield Protection Program provided technical assistance to local organizations involved in the study, which assessed needs and developed preservation strategies.
- **Priority Civil War Sites.** In 1992 NPS entered cooperative agreements with organizations at priority Civil War sites to assist with interpretation and preservation. Cooperators include local governments, property owners, the Civil War Battlefield Foundation, National Trust for Historic Preservation, Civil War Society, and Association for the Preservation of Civil War Sites.

to 2,500 partnerships in 1992. In 1992 partners turned $12 million in federal funds into $31.4 million in habitat improvements. BLM enlists partners such as the Global ReLEAF program, sponsored by the American Forestry Association, which in 1992 assisted public land restoration in Nevada, New Mexico, Wyoming, and Arizona. In the Nevada project, 150 volunteers planted aspen, cottonwood, willow, and other shrubs along the Marys River to restore habitat for the Lahonton cutthroat trout. Cosponsoring the project were BLM, Nevada Mining Association, Nevada Chapter of Trout Unlimited, Fish and Wildlife Foundation, and Global ReLEAF.

Take Pride in America. This national public awareness campaign encourages responsibility and pride in America's natural, historic, and cultural resources. The program relies on volunteers and in-kind contributions from private sources on efforts such as the following:

- **America's Treeways.** Federal, state, and private groups are cosponsoring this program, in which volunteers have planted hundreds of thousands of trees donated by forest industries along U.S. highways.
- **U.S. Virgin Islands Cleanup.** Sponsored by a coalition of community groups, this project enlists volunteers of all ages to adopt an area—beach, park, or roadway—and accept responsibility for its cleanup.
- **National River Cleanup Week.** A new event, sponsored in 1992 by a coalition of federal agencies and national conservation groups, resulted in the cleanup of 6,000 river miles by 20,000 volunteers.

Technology

Also see Energy, International Issues, Pollution Prevention, and related tables and figures in Part II.

Technology encompasses the methods and machinery used to apply scientific knowledge to specified objectives. In the 1990s it can be the cause of an environmental problem or the solution.

Conditions and Trends

At an increasing rate, U.S. research organizations—public and private—are developing, implementing, and marketing technologies to fix environmental problems or achieve social objectives with the least possible impact on the environment.

A Growing Global Market

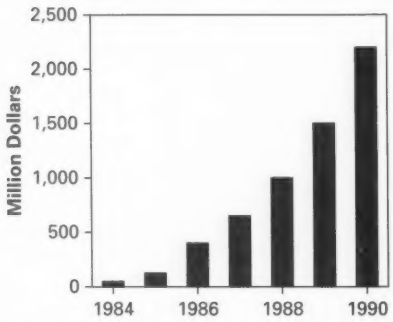
The market for environmental technologies is large and growing. The global market for environmental goods and services is in the estimated range of $200 billion to $300 billion per year and rising by 5-10 percent per year. An increasing share of this market is available to U.S. exporters. Expansion in this field will result from the following factors:

- New international environmental accords;
- Increased government investment in environmental technology, and
- Market-based environmental programs such as the 1990 Clean Air Act Amendments that create economic incentives for pollution prevention.

Public-Private Collaboration

The federal government funds just under half of all research and development (R&D) in the United States but performs only about 10 percent in its own laboratories. Industry conducts nearly 75 percent of the nation's R&D, and academia, about 10 percent. Recognizing the national economic benefits to be gained from increased public-private cooperation on technology R&D, the Congress enacted the Federal Technology Transfer Act of 1986. Under its provisions, the number of cooperative R&D agreements (CRADAs) between

Sales of biotechnology products.



Note: Products include recombinant DNA and hybridoma techniques.

Source: U.S. Department of Commerce, *1991 U.S. Industrial Outlook,* (Washington, DC: DOC, 1992).

government labs and private companies increased from 460 in 1990 to 730 in 1991, with a total number to date of 1,100. A quarter of these CRADAs are with small businesses, and many involve technologies relevant to environmental protection.

Key Technologies

Recent surveys of national technology priorities reflect the need for cleaner, more efficient methods in fields ranging from manufacturing to transportation to agriculture. For example, the Twenty-first Annual Report of the Council on Environmental Quality reviewed current programs and policy reforms needed to spur development of technology to prevent pollution. A 1992 report of the World Resources Institute (WRI), a private, nonprofit environmental group, proposed a list of environmentally critical technologies with the following criteria:

- Their use brings about large, cost-effective reduction in environmental risk;
- They embody a significant technical advance;
- They are generic—applicable to broad sets of problems—and precompetitive—at a stage where R&D costs are too high for any one company to bring to market; and
- Their adoption involves a favorable ratio of social-to-private returns.

The CEQ and WRI studies both noted that many technologies developed primarily for other purposes, such as supercomputers and computer-integrated manufacturing, may also have significant environmental uses.

Policies and Programs

Because technology is diffused—pervasively and rapidly—in modern society, no government can successfully centralize and direct its development. However, the U.S. Government supports and influences technology R&D through a variety of programs. Partnerships involving many federal departments, agencies, and private organizations create economies of scale and enhance innovation.

Federal Research and Development

The Office of Science and Technology Policy (OSTP) in the Executive Office of the President coordinates and integrates federally sponsored science and technology development through an interagency mechanism known as the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET). Much of the research conducted through FCCSET is relevant to long-term environmental issues. In addition, several other agency-specific and interagency technology development projects are underway.

List of key technologies.

OSTP national critical technologies	DOC emerging technologies	DOD critical technologies
Aeronautics and surface technology		
Aeronautics		
Surface transportation		Air-breathing propulsion
Biotechnology and life sciences		
Applied molecular biology	Biotechnology	Biotechnology materials and processes
Medical technology	Medical devises and diagnostics	
Energy and environment		
Energy technologies		No national critical counterpart; high-energy density materials, hypervelocity projectiles, pulsed power, signature control, weapon system environment
Pollution minimization, remediation, and waste management		
Information and communications		
Software	High-performance computing	Software producability,
Microelectronics and optoelectronics	Advanced semi-conductor devices	Semiconductor materials and microelectronic circuits,
	Optoelectronics	Photonics
High-performance computing and networking	High-performance computing	Parallel computer architectures
High-definition imaging and displays	Digital imaging	Data fusion
Sensors and signal processing	Sensor technology	Signal processing Passive sensors Sensitive radars Machine intelligence and robotics
Data storage and peripherals	High-density data storage	Photonics
Computer simulation and modeling	High-performance computing	Simulation and modeling Computational fluid dynamics
Manufacturing		
Flexible computer-integrated manufacturing	Flexible computer-integrated manufacturing	
Intelligent processing equipment	Artificial intelligence	Machine intelligence and robotics
Micro- and nano- fabrication		
Systems management technologies		
Materials		
Materials synthesis and processing	Advanced materials	Composite materials
Electronic and photonic materials	Advanced semi-conductor devices	Semiconductor materials and microelectronic circuits
	Superconductors	Superconductors
Ceramics	Advanced materials	Composite materials
Composites		
High-performance metals and alloys		

Note: The National Critical Technologies Panel of the Office of Science and Technology (OSTP), Executive Office of the President, designated national critical technologies; the Department of Commerce (DOC) designated emerging technologies; and the Department of Defense (DOD) designated critical technologies.

Source: National Critical Technologies Panel, *Report of the National Critical Technologies Panel*, (Washington, DC: OSTP, 1991).

Committee on Industry and Technology (CIT). Coordinated by FCCSET, this committee supports research and assists private industry in the development of technology. CIT sponsors an interagency initiative in Advanced Manufacturing Technology (AMT), whose environmental component emphasizes development in the following areas:

- Environmentally benign manufacturing processes;
- Waste minimization;
- Advanced pollution monitoring and sensors; and
- Closed-loop recycling.

Subcommittee on Environmental Technology (SET). Administered by the FCCSET Committee on Earth and Environmental Sciences, SET fosters interagency coordination for the research, development, and demonstration of solutions to environmental problems. SET coordinates the following efforts:

- Basic research for innovative technologies;
- Applied research for solving environmental problems; and
- Demonstrations or pilot projects to foster rapid application of the products of new technologies.

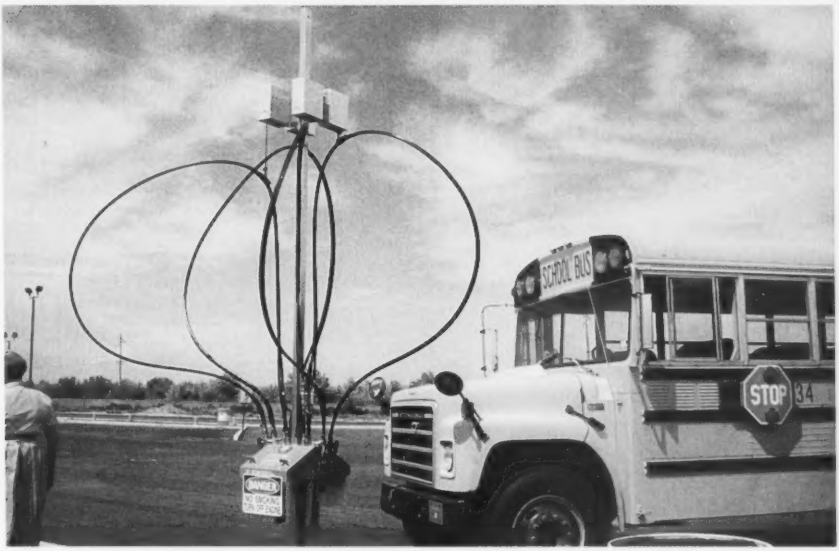
Private Enterprise/Government Interaction (PEGI). The FCCSET Committee on Earth and Environmental Sciences also administers the PEGI Task Group, which facilitates R&D interactions and collaborative efforts between the private sector and federal agencies, with an emphasis on global change issues. In 1992 PEGI collaborated with the Electric Power Research Institute, GEOSAT, Gas Research Institute, and American Petroleum Institute.

Strategic Environmental Research and Development Program (SERDP). In 1990 the Congress directed the Department of Defense (DOD) and the Department of Energy (DOE) to establish SERDP to identify DOD and DOE programs developed for defense purposes but possessing useful applications in the environmental field. For example, data gleaned from submarines and orbiting satellites could help scientists track long-term environmental changes. SERDP also conducts environmental research with private sector and government organizations.

NICE^3 Program. Established in 1991 the National Industrial Competitiveness through Efficiency—Environment, Energy, and Economics program (NICE^3) is a $2 million grant program jointly administered by the Department of Commerce (DOC), the Environmental Protection Agency (EPA), and DOE to fund development of generic, precompetitive technology to enhance industrial competitiveness through improved energy efficiency. Grants are awarded to state and industry consortia to develop energy efficient technologies with promise of commercial viability for U.S. industry. For example, a project was funded in Ohio to develop a new curing system for solvents in the manufacture of pressure-sensitive labels. This technology could result in an estimated savings of 604 billion British thermal units (Btu) per year, with an annual reduction of 7 million pounds of hazardous waste. For more information on NICE^3, see the Pollution Prevention section.

Innovative Concepts Program (InnCon). Sponsored by DOE, EPA, and the Department of the Interior,

New Mexico CNG Partnership.



New environmental technologies are promoting compressed natural gas as an alternative fuel.

InnCon provides seed money in amounts up to $20,000 to innovators who develop energy efficient technology and processes that increase industrial productivity. The program also supports innovators by publicizing their concepts and by introducing them to potential sponsors. The program, in its sixth year, has provided $11.5 million in funding for innovative environmental technology.

EPA Technology Innovation Office. This office promotes new cleanup methods for problems such as contaminated soils or groundwater. In 1991 EPA conducted 21 pilot and full-scale field demonstrations of new technologies prior to commercialization and scheduled 74 new technologies for demonstration. Among the techniques tested in 1992 were soil washing, chemical dechlorination, underground vacuum extraction, and the forcing of airstreams through water to evaporate volatile organic compounds. EPA also evaluated bioremediation—the use of microbes to break down organic contaminants—at demonstration cleanups across the country.

U.S. Bureau of Mines, Division of Environmental Technology. This office conducts research on innovative ways to achieve the following objectives:

- Reduce the volume and toxicity of mining and minerals-processing wastes;
- Identify hazardous waste sites contaminated with heavy metals and other toxic constituents; and
- Mitigate the environmental impacts resulting from active and abandoned coal and other mining.

Recent work has applied biotechnology to remediate toxic and hazardous waste

Technology Transfer in Energy Efficiency

U.S. federal agencies, led by the Department of Energy (DOE), are promoting the transfer of energy efficient technology worldwide through efforts such as the following:

Committee on Renewable Energy, Commerce, and Trade (CORECT). This interagency committee focuses on market assessments for export of renewable energy technologies. Committee members represent DOE, the Department of Commerce (DOC), and the U.S. Agency for International Development (USAID). CORECT has supported photovoltaics in the Dominican Republic, wind systems in Guatemala, and geothermal energy in Honduras.

Technology Transfer Clearinghouse. An Environmental and Energy Efficient Technology Transfer Clearinghouse is being supported by USAID, DOE, and the Environmental Protection Agency (EPA). The clearinghouse provides information on pollution control, renewable energy, and energy efficient technologies. Pilot programs are in process in Mexico City and Vienna.

Assisting Deployment of Energy Practices and Technologies (ADEPT). This program helps nations to choose and apply energy technologies. Joint ventures, sponsored by DOE and host country governments, involve personnel from U.S. national laboratories, industrial groups, and host-country counterparts. ADEPT emphasizes indigenous fuel sources—biomass, geothermal, solar, and wind—and improved efficiency in fossil fuel use.

21st Century Program. Through the Americas' 21st Century Program, DOE is assisting the U.S. renewable energy industry to form joint ventures with nations of Latin America and the Caribbean.

Other DOE Programs. DOE also is participating in international programs to help other countries achieve the following objectives:

- Capture methane released in coal mining;
- Develop small hydropower projects; and
- Conserve electricity through demand-side management.

sites created by mining, minerals processing, and related industries. These projects also provide a foundation for environmental regulatory analysis and development.

Marketing New Technologies

To complement its support for environmental technology R&D, the federal government also administers programs designed to accelerate the commercialization and deployment of new technologies.

National Technology Initiative. DOC, DOE, and EPA sponsor this initiative to promote public-private cooperation on technology development and commercialization. In 1992 the agencies cosponsored a series of ten conferences for entrepreneurs across the

country to highlight opportunities for partnerships among federal agencies, universities, and the private sector on cooperative R&D, financing, and manufacturing. Five additional conferences are scheduled, and, in response to industry interest, DOE and EPA are organizing follow-on workshops.

Cooperative Research Centers/ Engineering Research Centers. Funded by the National Science Foundation, this program has established a network of cross-disciplinary centers at major research universities, linking academia and industry. Currently, 23 centers are in operation at 21 universities in 16 states around the nation. The centers focus on environmental problems and technology solutions in fields such as microelectronics, telecommunications, biotechnology, energy resources and recovery, and design and manufacturing.

International Cooperation. As world leaders in science and technology, Americans are working with their counterparts in other nations to develop and share technological advances. In particular, the United States supports an active program of environmental technology cooperation with developing nations and those making the transition to market economies. Cooperation takes the form of information exchange, training and technical assistance, and financial assistance for selected projects. A sampling of current efforts follows.

United States-Asia Environmental Partnership (US-AEP). This coalition of U.S. and Asian businesses, government agencies, and community groups seeks to protect the environment and promote economic progress in the Asia-Pacific region. US-AEP is establishing centers in Hong Kong, Taiwan, the Philippines, and India. Additional sites are under consideration for Malaysia, Singapore, Thailand, Indonesia, and Korea. The US-AEP program has the following components:

- Technology cooperation;
- Environmental fellowships and training,
- Environmental infrastructure, and
- A regional biodiversity conservation network.

Technology cooperation fosters opportunities through trade, investment, and business exchanges. The partnership is establishing environmental business centers in Asia to support trade and investment linkages. The Agency for International Development (USAID) administers U.S. efforts in the program with input from 20 other federal agencies.

U.S. Environmental Training Institute (USETI). This joint effort of U.S. industry and seven federal agencies provides training to professionals from public and private sectors of developing countries. In 1992, its first year of operation, the institute offered five courses at U.S. facilities on such topics as advanced landfill management, bioremediation, and restoration of nuclear sites. Attending the courses were environmental professionals from Thailand, India, Hong Kong, Morocco, South Korea, Taiwan, Mexico, Indonesia, the Philippines, and Puerto Rico.

Climate Country Studies. The United States has committed $25 million over two years to assist developing nations with needs assessments and reporting obligations under the United Nations Framework Convention on Climate Change. Country studies will facilitate future U.S. assistance to developing nations in taking actions to mitigate and adapt to climate change.

National Environmental Technology Applications Corporation (NETAC). Established in 1988 at the University of Pittsburgh's Applied Research Center with funding from EPA and the private sector, NETAC is accelerating the application of environmental technologies at home and abroad. NETAC has undertaken 11 cooperative technology projects in Eastern and Central Europe and the former Soviet Union, involving such organizations as USAID, the U.S. Information Agency, and the private, nonprofit World Wildlife Fund. In one example, NETAC conducted an independent evaluation of a biological remediation process, which the client was able to use to successfully market the technology.

Transportation

Also see Air Quality, Energy, International Issues, Wetlands, and related tables and figures in Part II.

The mobility of people and goods is essential to national wellbeing and competitiveness in the world marketplace. The vast U.S. transportation system supports the nation's dynamism and freedom. At the same time, transportation consumes much energy and space and produces a large portion of the nation's pollution problems. The transportation corridor and infrastructure can contribute to habitat stress and ecosystem disruption, and transportation accidents involving hazardous cargoes can have major adverse impacts on human health and the environment.

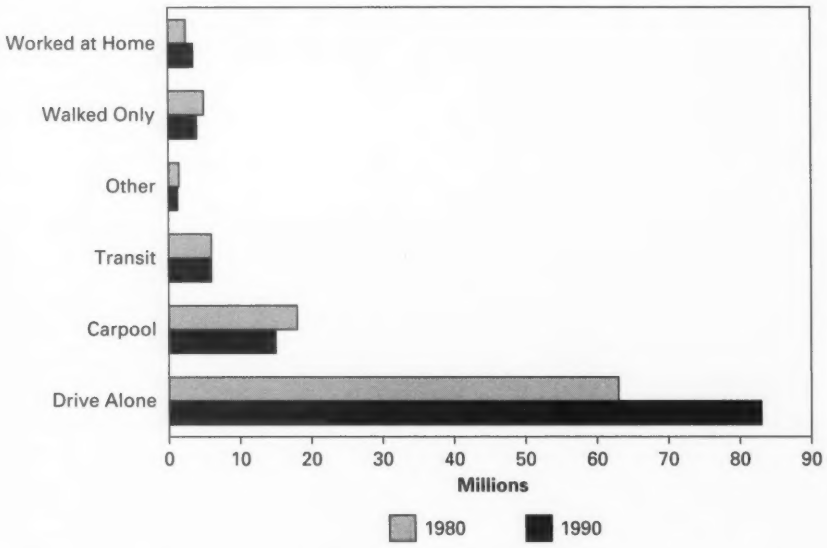
Conditions and Trends

The U.S. transportation network is an ever-changing complex of public and private roads, airports, transit systems, railroads, ports, waterways, and pipelines. In the 1990s the nation asks transportation planners to ensure that the system grows and operates in a manner compatible with the environment.

During this century and especially since the 1950s, the U.S. transportation system has come to be dominated by petroleum-powered automobiles and trucks, especially for personal travel. As part of this shift to motor vehicle travel, other significant changes have occurred. For example, in 1992 the Department of Transportation (DOT) issued a report on commuting, which indicated that from 1980 to 1990, the number of vehicles on the road grew 17.4 percent, almost twice as fast as the 9.7 percent increase in the number of workers. The number of drive-alone commuters increased faster than any other mode of travel, while carpooling declined, and most carpools involved only two people. Commuting by transit declined slightly, and those working at home increased slightly.

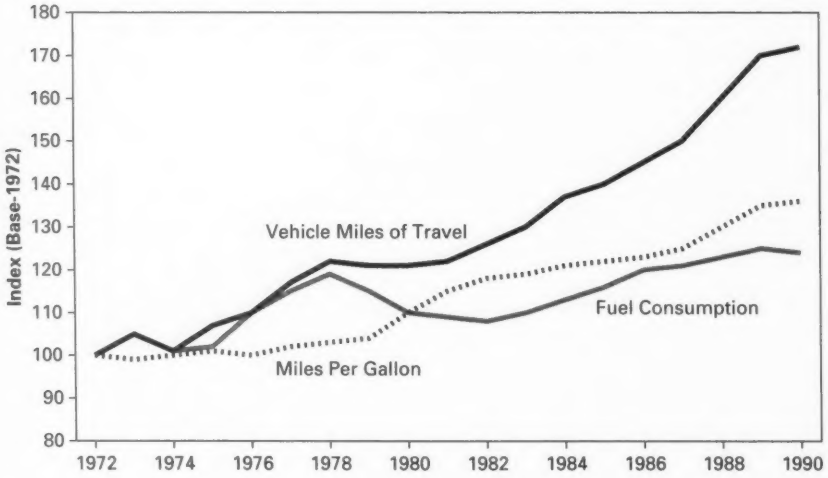
Trends in highway travel and fuel consumption diverged in recent years.

Travel modal trends of commuters.



Source: U.S. Department of Transportation, Federal Highway Administration, Office of Highway Information Management, *New Perspectives in Commuting,* (Washington, DC: DOT, July 1992).

Highway travel and fuel consumption.



Source: U.S. Department of Transportation, Federal Highway Administration, *Selected Highway Statistics and Charts, 1990,* (Washington, DC: DOT, 1991).

In 1990 highway travel in the United States totaled 2.2 billion vehicle miles, up 2.4 percent since 1989, while highway use of motor fuel was 131.6 billion gallons, a slight decrease from 1989. The shift is attributed in part to a steady rise in the average fuel economy of automobiles.

The most severe problem affecting America's highways is congestion. The Federal Highway Administration reported that 65 percent of peak-hour travel on urban interstate highways was congested in 1987, up from 49 percent in 1981; on rural highways, that figure rose from 4 percent to 17 percent; and truck traffic alone increased by 44 percent. Traffic congestion, which wastes billions of dollars in lost time, money, and fuel, also is a major factor in causing smog.

The predominant mode in terms of volume for intercity freight is rail, followed by waterways, highway, pipeline, and air. U.S. freight railroads have substantial excess capacity and in the last decade have invested heavily in advanced technology to improve performance. Railroads are more fuel efficient than trucks and barges and, even while carrying more total freight, emit far fewer air pollutants. And while all transportation modes pose serious risks from accidents involving hazardous materials, the accident rate of railroads has declined by about two-thirds and that of trucks by about one-third since 1980.

Oil tanker safety has improved markedly in recent years, possibly because of stricter federal and state rules adopted since the 1989 Exxon *Valdez* spill. According to a private study conducted for the Department of Energy, tankers in 1991 spilled 55,000 gallons of oil or petroleum products in U.S. waters, the lowest level in 14 years. The study found that no major spills occurred in the first six months of 1992 and that tanker operators were taking increased safety precautions.

Policies and Programs

In 1992 DOT worked to bring the U.S. transportation system into greater harmony with the environment, especially to reduce transportation's contribution to air pollution. Recent legislation, including the 1991 Intermodal Surface Transportation Efficiency Act (ISTEA), the 1990 Clean Air Act Amendments, and the Oil Pollution Act of 1990, contain numerous provisions that will change the way the nation moves people and goods.

Surface Transportation

The 1991 Intermodal Surface Transportation Efficiency Act established new sources of funding for environmental initiatives, increased flexibility in the major funding categories, and set more rigorous planning requirements. While ISTEA will result in large new investments in highway and transit programs, scarcity of land and traffic congestion suggest the need for emphasis on maximizing the efficiency of the system, not just expanding capacity.

Environmental Initiatives. ISTEA dedicated funds to mitigate congestion, improve air quality, and enhance transportation. In fiscal 1992 the law authorized $809 million for an air quality program and $353 million for transportation enhancement, which includes historic preservation, greenways, bicycle paths, and efforts to protect scenery and water quality. DOT

America's Treeways: Planting Trees along Highways

As part of President Bush's America the Beautiful tree-planting initiative, a coalition of public and private organizations is planting thousands of trees along U.S. highways. Cosponsors include the DOT Federal Highway Administration, the USDA Forest Service, the DOI Take Pride in America program, the National Tree Trust (a private foundation), the National Association of State Foresters, and state departments of transportation. The program relies on volunteers to plant and care for trees donated by forest product companies.

In 1992 volunteers planted 500,000 trees on highway rights-of-way primarily in Ohio, with Michigan, Texas and Virginia undertaking programs. Trees planted along U.S. highways benefit the environment in several ways:

- Enhance visual beauty and roadside scenery;
- Create habitats for wildlife and plants;
- Improve air quality;
- Reduce soil erosion by controlling water runoff; and
- Provide windbreaks and shade.

Planting trees promotes the spirit of volunteerism across the country, educates children about the environment, and builds partnerships among groups and individuals concerned with the preservation of nature.

worked closely with CEQ, EPA, and the Department of Justice to set environmental priorities and to select environmental indicators and, in April 1992, issued guidelines for use of the new funding categories.

Funding Flexibility. In the major infrastructure projects of the surface transportation program, ISTEA provided greater spending flexibility, which can allow for an increase in environmental benefits. For example, during fiscal 1992 the act obligated $243 million to mass transit projects from traditional highway revenue sources. This amount was in addition to $3.8 billion available in fiscal 1992 transit funds.

Transportation Planning. In late 1992 DOT drafted funding provisions for transportation planning at the metropolitan and state levels. Integrated transportation, land-use, and environmental planning yields transportation projects that prevent or minimize such adverse environmental impacts as air and water pollution, habitat fragmentation, and disruption of communities.

In related efforts, the DOT Federal Highway Administration (FHWA) and the Environmental Protection Agency (EPA) signed a memorandum of understanding that provides a framework for enhanced coordination in 13 key environmental areas. The Clean Air Project of the National Association of Regional Councils, funded jointly by EPA and DOT, provided technical guidance to metropolitan planning organizations on clean air issues, including guidance on best modeling practices.

DOT also continued efforts to streamline processing of wetlands dredge and fill permits for transportation projects. DOT, the Army Corps of Engineers, and EPA signed a joint memorandum to field staffs aimed at

improving coordination on transportation projects involving complex wetlands issues.

Intermodalism. The degree to which the various parts of a transportation system, such as highways, airports, and railroads, work together in a harmonious whole—intermodalism—is one of the factors determining the effectiveness and efficiency of the nation's transportation system. In response to ISTEA, the Department of Transportation formed an Office of Intermodalism to maintain and distribute intermodal transportation data, coordinate federal research on the subject, and oversee grants to states to develop model transportation plans.

Auto Fuel Efficiency. In 1992 the costs and benefits of proposed major increases in corporate average fuel economy (CAFE) standards were debated in the Congress during deliberations on national energy legislation and also in the 1992 presidential campaign. Some lawmakers proposed increasing the CAFE standard for passenger cars from the present 27.5 miles per gallon to 40 miles per gallon by the year 2000; presidential candidate Bill Clinton proposed reaching 45 miles per gallon by 2010.

In response to a request by DOT, the National Academy of Sciences published a report in April 1992 addressing potential fuel economy levels for new cars and light trucks through model year 2006. The study identified several technologies that would lead to improved fuel economy but also noted other factors that should be considered:

- Tighter tailpipe emission standards mandated by the 1990 Clean Air Act Amendments;
- Consumer preferences for larger vehicles, especially among senior citizens and farmers;
- Potentially increased costs per vehicle; and
- Impacts on employment and international competitiveness.

Bicycling and Walking

Bicycling and walking are two environmentally benign, low-cost, healthy ways to get around. In 1993 DOT will submit a National Bicycling and Walking Study to the Congress, outlining how federal, state, and local governments, private organizations, and individuals can work together to increase bicycling and walking. The report includes new data on bicycling and walking and examines such issues as safety and health benefits.

Railroads

The efficiency of rail transportation suggests that it may gain increased prominence in the transportation debates of the 1990s. In recent years, in addition to passage of ISTEA, the primary issues affecting railroads and the environment have involved advanced technologies and wetlands protection.

High Speed Rail. Magnetically levitated (maglev) trains are an energy-efficient, high-speed mode of ground transportation. In 1990 the DOT Federal Railroad Administration (FRA) formed the interagency National Maglev Initiative in cooperation with the U.S. Army Corps of Engineers, the Department of Energy, and EPA. The National Maglev Initiative is working with the private sector and state governments to assess the potential of these high speed trains. The goal is to improve intercity transportation in the twenty-first century through development of a commercially viable maglev system. Further research will determine the technological, economic, environmental, and safety issues associated

M. Katz.

High-speed trains are an energy efficient mode of ground transportation.

with maglev, as well as its potential role in the United States.

The first commercial maglev system in the world is being planned in the Orlando, Florida, area. The DOT Federal Highway Administration, DOT Federal Railroad Administration, and the Florida Department of Transportation jointly are preparing an environmental assessment for this project, the first assessment of its kind. FRA and the Texas High Speed Rail Authority are preparing an environmental impact statement on proposed high-speed rail projects between Dallas/Ft. Worth and Houston, and between Dallas/Ft. Worth and San Antonio.

Historic Preservation. Along Amtrak's Northeast Corridor, restored railroad stations in New Haven, Connecticut, and Washington, D.C., received recognition as winners of the 1992 National Historic Preservation Awards for rehabilitation of public buildings. With FRA financial and technical assistance, the two stations were updated to meet current demands while preserving historic elements. The award is administered by the Advisory Council on Historic Preservation.

Wetlands Protection. In 1992 DOT became a partner in Coastal America, an intergovernmental initiative to enhance the coastal environment. In particular, DOT is participating in a project involving the EPA, Department of Commerce, Army Corps of Engineers, and State of Connecticut to restore coastal marshes along the Amtrak railroad line. The project will take advantage of ISTEA provisions that allow federal-aid highway funds to be used to support wetlands conservation efforts. Other states may also use

this expanded funding flexibility to establish wetlands conservation banks and wetlands conservation plans. For more information on Coastal America, see the Coasts and Oceans section.

Airport Noise

The Airport Noise and Capacity Act of 1990 set national aviation noise policy and provided for a transition to a quieter aircraft fleet. In September 1991 the DOT Federal Aviation Administration (FAA) issued rules to phase out noisier aircraft by December 31, 1999, using an interim compliance schedule. In 1992 FAA received the first set of annual compliance reports, which indicated that the percentage of the noisier Stage 2 airplanes in the national fleet fell below 50 percent for the first time. Implementation of other regulations required by the Airport Noise Act has also begun.

Hazardous Materials Transportation

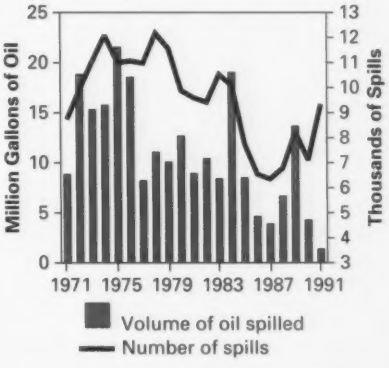
The Hazardous Materials Transportation Uniform Safety Act of 1990 imposed standards for use by states and Native Americans in setting and enforcing routes for transportation of certain hazardous materials. In July 1992 the DOT Research and Special Programs Administration (RSPA) issued a rule establishing a national registration program for certain shippers and carriers of hazardous materials and a collection system to fund a national emergency response training and planning grant program. In addition to these standards, RSPA developed the following regulations to coordinate U.S. domestic requirements with various international agreements:

- **Packaging Standards.** Several rules issued in 1990 to conform with United Nations recommendations on hazardous materials packaging became effective in 1992. The U.N. recommendations provide performance-oriented standards that encourage innovation and facilitate international commerce.
- **Marine Pollutants.** In 1991 the U.S. Senate ratified Annex III of the International Convention for the Prevention of Pollution from Ships, which mandated changes in the list of materials identified as marine pollutants by the International Maritime Organization. Currently the DOT Research and Special Programs Administration is developing regulations to implement the treaty obligations.

Marine Transportation and Oil Pollution

The Oil Pollution Act of 1990 (OPA) strengthened the authority of the federal government to prevent oil spills in marine and freshwater environments.

Oil spills in U.S. waters.



Note: 1981 data include two spills of undetermined size.

Source: Adapted with permission of World Information Systems from *Gelob's Oil Pollution Bulletin,* 1992.

It provided for the cleanup of spills and compensation for public and private damages, without preempting states rights of recovery. DOT administers the law in cooperation with EPA.

Pollution Response. DOT regulations proposed in 1992 would require tank vessels and marine transportation facilities to develop oil spill response plans to be in place by February 1993 and operating by August 1993. Vessels transporting oil and hazardous bulk cargo would be required to carry pollution discharge removal equipment. Response plans also would be required for other kinds of transportation facilities, such as pipelines, rails, and highways.

In response to OPA, the Coast Guard placed pollution response equipment in each of its 49 marine safety units located in ports throughout the United States and purchased enhanced response equipment for 19 sites.

As of September 1992 a new Coast Guard Atlantic Strike Team became fully operational for both oil and hazardous substance spill response. The National Strike Force Coordination Center in Elizabeth City, North Carolina, administers Atlantic, Gulf, and Pacific Strike teams. The center trains federal on-scene coordinators in pollution response and provides technical assistance, equipment, and other resources in the event of a spill.

Liability. In response to OPA, the Coast Guard created the National Pollution Funds Center in February 1991 to address funding, liability, and damage claims arising from discharges and threatened discharges of oil. In August 1992 DOT issued an interim rule establishing procedures for filing of claims for removal costs or damages resulting from the discharge of oil.

Double-Hull Tankers. Under OPA, new tank vessels operating in U.S. waters must be constructed with double hulls, and existing single-hull vessels must be phased out between 1995 and 2015. In August 1992 DOT issued an interim rule providing guidance on double-hull construction.

DOT also sponsored a 1991 National Academy of Sciences study on alternative tank vessel design, which found the double hull to be an effective design and recommended further study of the mid-deck design. In addition, the Coast Guard has participated in efforts by the International Maritime Organization to evaluate alternatives to double-hull construction and is preparing a report on the subject to the Congress.

Nonregulatory Initiatives. States have considerable leeway under OPA in regulating the maritime industry, which often results in inconsistent federal and state requirements regarding pollution prevention, preparedness, liability, and response. To address this problem, the Coast Guard has begun a program to improve coordination with states and to seek a consistent marine environmental protection strategy. The Coast Guard will encourage and support regional initiatives that bring citizen groups and marine industry associations together to foster long-term environmental compliance.

Maritime Oil Pollution. In March 1992 the United States became the first nation to ratify the International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC), negotiated under the auspices of the International Maritime Organization

Worst chemical transportation hazards.

Commodity	Class	Incidents	Deaths	Injuries
Anhydrous ammonia	NonFG	589	2	81
Chlorine	PG	70	0	55
Compound cleaning liquid	CM	3,694	0	34
Compressed gas	NOS/NonFG/FG	182	1	29
Corrosive liquids	NOS/CM	4,152	1	115
Flammable liquids	NOS/FL	3,784	1	125
Fuel, aviation turbine	FL	149	3	4
Fuel oil, No. 1,2,4,5,6	CL	2,233	5	7
Gasoline	FL	3,560	52	82
Hexane	FL	98	2	1
Hydrochloric acid solution	CM	2,788	2	134
Naphtha	CL	11	2	0
Naphtha petroleum	CL/FL	777	2	13
Paint or paint related	FL	1,812	2	15
Petroleum crude oil	CL/FL	404	6	2
Petroleum gas liquified	FG	796	12	60
Resin solution	FL	2,370	0	33
Sodium hydroxide solution	CM	1,699	0	84
Sulfur dioxide liquified	PG	43	1	77
Sulfuric acid	CM	2,800	0	238
Toluene	FL	414	2	6

Note: Information is for incidents filed from 1982-1991. Of 22 DOT hazardous classes, the following six represented the worst transportation hazards:

CL = Combustible liquid
CM = Corrosive material
FG = Flammable gas
FL = Flammable-combustible liquid
NonFG = nonflammable gas
PG = Poison gas
NOS = Not otherwise stated, a generic form that cannot be characterized by a more specific category.

Source: U.S. Department of Transportation, Hazardous Materials Safety, Hazardous Materials Information System, Washington, DC, 1992.

(IMO). The convention—proposed by President Bush in June 1989 and completed 17 months later—protects the marine environment from oil spills and calls for planning, reporting, technology sharing, and cooperation. OPRC requires parties to establish national systems for preparedness and response, a system the United States established through the 1990 Oil Pollution Act. The U.S. Coast Guard is working with IMO to refine OPRC implementation plans and to bring existing bilateral contingency plans with Canada, Japan, Mexico, Bermuda, and Russia into conformity with the convention.

Water

Also see Agriculture, Coasts and Oceans, Wetlands, and related tables and figures in Part II.

Streams and rivers, lakes and ponds, and groundwater aquifers supply water for U.S. homes and businesses. In addition, the nation's aquatic resources support irrigation, electric power, navigation, fisheries, wildlife habitat, and recreation. Once managed as separate entities according to political boundaries, water resources increasingly are managed as interconnected, essential parts of large aquatic ecosystems.

Conditions and Trends

Water-related issues tend to fall into two categories—water quantity and water quality—for surface water and for groundwater.

Water Quantity

In 1992 the nation's potable freshwater needs were met by withdrawals from rivers, streams, lakes, reservoirs, and groundwater aquifers. On a national scale, water quantity was ample, with 1.4 billion gallons per day of renewable water supplies withdrawn in the lower 48 states, up from offstream withdrawals of 408 billion gallons per day in 1990.

A different picture emerges, however, at the regional level, because of an uneven natural distribution of the resource in relation to regional and seasonal water demand. Rising demands for limited supplies in certain parts of the nation, particularly the West, are matters of public concern on a number of fronts—health, environmental, economic, recreational, and industrial. Changes in engineering, management, or public behavior can alleviate some of this concern.

The natural availability of water in any geographic area is determined by hydrologic conditions, which reflect the continual circulation of water from the sea to the atmosphere to the land and back again. The amount of rain and snow is the primary factor in the availability of surface water resources. Average annual precipitation in the

United States is 30 inches per year; however, the range varies from a few tenths of an inch per year in the desert areas of the Southwest to 400 inches per year at some locations in Hawaii.

Surface Water. Streamflows are the standard measure of water quantity, whether in-stream or off-stream and whether for recreation, irrigation, or public water supplies.

- **National Water Conditions Report.** Six-year streamflow trend data (1986-1991) issued by the U.S. Geological Survey for 12 hydrologic areas illustrate the variation in natural distribution of water supplies across the nation. Based on this data, 1991 monthly streamflow is above the long-term median in four basins, at the median in five basins, and below the median in three basins.
- **Augmenting Supplies.** The following methods can increase the efficiency of surface-water use for potable water supply:
  - Manmade surface-storage reservoirs;
  - Water conservation;
  - Improved water system management;
  - Reuse of water of impaired quality or water recycling;
  - Reduction of evaporation from the soil, surface-water bodies, and plants; and
  - Greater utilization of groundwater aquifers through conjunctive use of groundwater and surface water.

  Although surface-storage reservoirs can augment natural water supplies, construction is limited by such factors as cost, competing land uses, engineering problems, and environmental concerns associated with land inundation and diversion or removal of water from downstream aquatic systems.
- **Users.** Currently, irrigation use accounts for the greatest share of freshwater withdrawals, at 40 percent, with industrial use accounting for 6 percent of that total. Thermoelectric powerplants use the greatest share of both fresh and saline withdrawals combined, at 48 percent. Because this water is used for cooling purposes, most of it is returned to the source. Another major nonconsumptive use of managed water systems is the generation of hydropower.

  Nine states each withdraw greater than 10 billion gallons per day of surface water for combined offstream uses, constituting 42 percent of the total surface-water withdrawals in the country. The largest withdrawals occur in California, Illinois, New York, and Texas. Public water supply use continues to increase, reflecting population growth as well as an increase in per capita water use.

Groundwater. Although surface-water diversions continue to exceed groundwater pumping by volume, the nation has increased its use of groundwater for all purposes, except thermoelectric power generation. Groundwater provides drinking water supplies for 40-50 percent of the U.S. population. It also supplies 40 percent of average annual base flow to streams.

- **Use.** California, Idaho, Kansas, Nebraska, Texas, Florida, and Arizona—states where irrigated agriculture is common—use the most groundwater. While groundwater is currently an alternative to surface-water supplies, particularly during drought, it may in the future become the preferred source for water.
- **Overuse.** In water-deficient areas, such as Arizona, large volumes of

groundwater continue to be withdrawn to supply agricultural and municipal needs. Because of limited supplies, such withdrawals cannot be sustained indefinitely. In Florida, groundwater development has redistributed natural flow patterns in the aquifers, resulting in sinkholes, saltwater intrusion, and land surface subsidence. Groundwater mining in California's San Joaquin Valley has resulted in sediment compaction and land subsidence. Such development trends suggest the need to conserve existing groundwater supplies if the nation is to meet future water needs.

Floods and Droughts. Floods are natural and recurring hydrologic events that perform useful ecological functions, yet for people, they remain one of the most destructive natural hazards in the United States. Many areas of the country have flood-control facilities through programs of the Army Corps of Engineers, but many other areas susceptible to flooding remain unprotected. At the other extreme, droughts can severely reduce water availability and cause significant environmental and economic impacts. Adverse effects of a drought on water supplies depend on the amount of water stored or available from the preceding year, the water demands relative to average flow, soil conditions, and the natural flow during a drought period. The multi-year droughts of the late 1920s and 1930s resulted in extensive regional impacts. For the past several years, numerous river basins in the western states have experienced drought conditions.

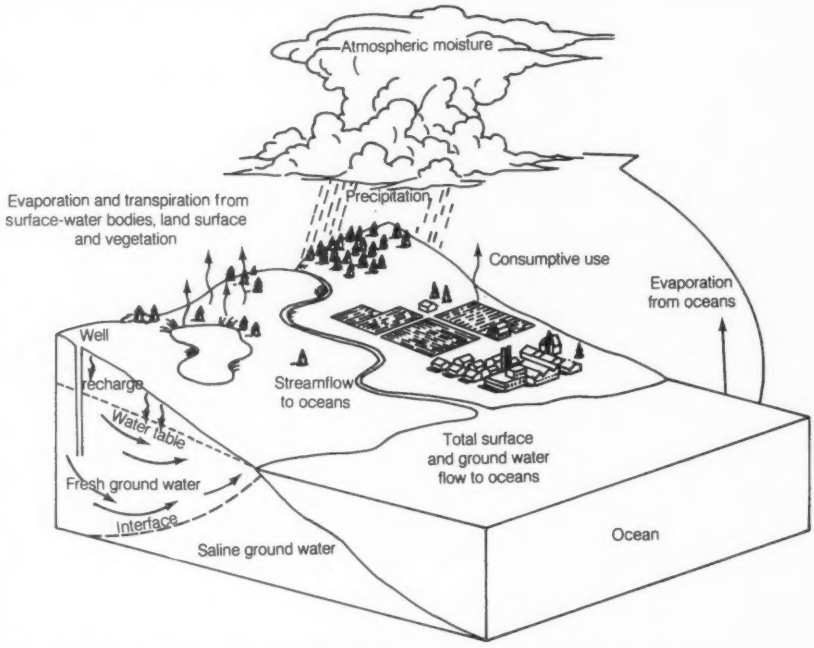
Water Quality

Despite decades of research and regulation, the federal government still lacks a comprehensive assessment of the quality of the nation's waters. Efforts to acquire this information depend, in part, on the states, which report every two years to EPA, which in turn reports to the Congress on the quality of the water in each state. Results are published in the EPA National Water Quality Inventory, also known as the 305(b) report. According to the 1990 National Water Quality Inventory, the states assessed about a third of total U.S. river miles, half of lake acres, and three-quarters of estuarine square miles, which represented a substantial increase over areas assessed for the previous 1988 water inventory.

Of assessed water resources, about two-thirds met federal water quality standards and achieved state-designated uses such as fishing, swimming, and drinking. One-third of the assessed waters did not fully meet designated uses. The major remaining impairment to water quality was wet-weather runoff from such sources as farmlands, city storm sewers, construction sites, and mines. Pollutants resulting from wet-weather runoff included siltation, pathogens, toxic chemicals, and excess nutrients that produce low dissolved oxygen levels capable of suffocating fish and contaminating groundwater. Loss of wetlands also can contribute to water quality problems.

Surface Water Impairment. The 1990 National Water Quality Inventory indicated that agricultural sources were by far the leading source of contaminants, contributing to 60 percent of the impaired stream miles and 57 percent of the impaired lake acres in the assessment. Agricultural pollutants included siltation, nutrients (fertilizers and animal wastes), and pesticides. For rivers and streams, sewage treatment plants followed agriculture as a source of contaminants, contributing to 16 percent of

Hydrological cycle.

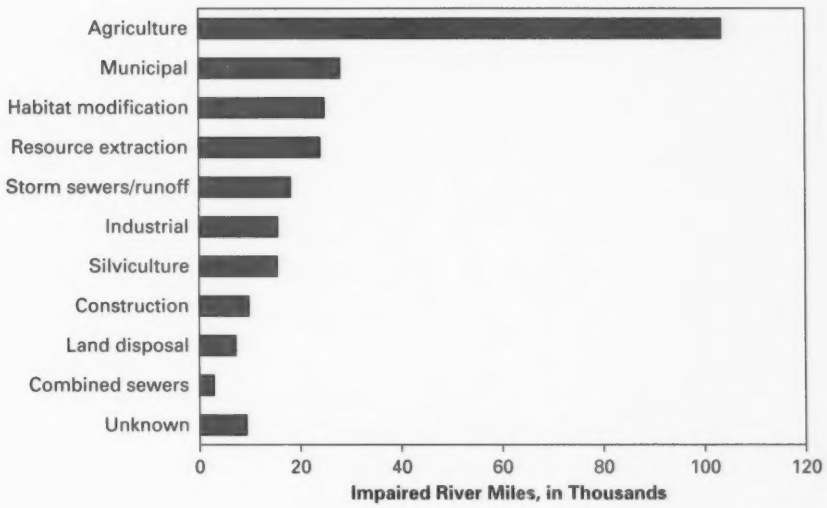


Source: Council on Environmental Quality, *Environmental Trends,* (Washington, DC: CEQ, 1989), page 21.

the impaired stream miles. For lakes, hydrologic/habitat modification contributed to 40 percent of impaired acres. Such impairments are not additive, since more than one source can contribute to impaired water quality.

Groundwater Impairment. For many years, land surface and subsurface disposal of wastes was considered safe and convenient. Only recently did researchers discover that natural processes have a limited capacity to convert contaminants into harmless substances before they reach groundwater. One EPA study estimates that more than half of the nation's land area has geologic factors that would allow groundwater contamination. The EPA 1992 National Pesticide Survey estimates that 10.4 percent of community water supply wells and 4.2 percent of rural domestic wells contain detectable levels of one or more pesticides. The study also estimates that 1 percent (68,500) of all U.S. drinking water wells exceed the EPA health-based limits on contaminants. Elevated levels of nitrates also have been detected in groundwater. These and other groundwater contaminants, such as organic and inorganic chemicals, radionuclides, and microorganisms may cause adverse health, social, environmental, and economic impacts. Among these impacts are the health risks of exposure to contaminants and expenditures such as groundwater purification systems. Because groundwater provides base

Sources of pollution in U.S. rivers.



Note: Based on river miles monitored in 1990, which represent 9.5 percent of total U.S. river miles.

Source: U.S. Environmental Protection Agency, *National Water Quality Inventory: 1990 Report to Congress,* (Washington, DC: EPA, 1992).

flow to streams, the potential for adverse impacts on surface-water quality also exists, especially under conditions where dilution is minimal.

Policies and Programs

Among the federal agencies with water-related responsibilities, the U.S. Geological Survey (USGS) in the Department of the Interior (DOI) provides the hydrologic information needed to manage the nation's water resources. EPA administers water pollution control and safe drinking water programs. The Army Corps of Engineers (COE) and EPA regulate water issues such as wetlands filling and ocean dumping. Several DOI bureaus conduct water quality programs on public lands, and the Bureau of Reclamation and COE oversee a vast system of levees, dams, and reservoirs for flood control, irrigation, hydropower, navigation, and environmental protection. In addition, many states assume principal administrative roles in managing water resources through delegated programs.

Water Quantity

Although the federal government administers a significant portion of the nation's water storage and conveyance facilities, water allocation and administration rests principally with the states. The Army Corps of Engineers and the Bureau of Reclamation provide federal assistance to the states for water quantity programs.

Key Points of the 1992 Water Bill

In signing the Reclamation Projects Authorization and Adjustment Act of 1992, known as the 1992 Water Bill, President Bush and the Congress enacted the most extensive western water policy legislation in decades. The legislation affects more than 24 water projects in 17 western states. Provisions include the following:

- **Central Valley Project**—expands the purpose of the California Central Valley Project, which distributes 20 percent of the state's developed water supply, from primarily irrigation to include municipal use and the restoration and protection of fish and wildlife habitat.
- **Central Utah Project**—authorizes $992 million for one of the last giant federal water projects under construction.
- **Glen Canyon Dam**—protects the Grand Canyon from environmental damage caused by fluctuating water releases from Glen Canyon Dam.
- **San Gabriel Valley**—authorizes the federal portion of funding for design, planning, and construction of a multipurpose facility to improve water quality and store water in the San Gabriel Valley groundwater basin.
- **Buffalo Bill Dam**—authorizes an $80-million expansion of the Buffalo Bill Dam and Reservoir in Wyoming, including construction of recreation facilities.
- **Salton Sea Area**—authorizes a $10-million saline water project in the Salton Sea area of California.
- **Mono Lake Basin**—initiates a project to develop 120,000 acre-feet/year of reclaimed water in Southern California to offset water diversions from the environmentally sensitive Mono Lake Basin.
- **Western Water Review**—calls for a comprehensive federal review of western water resource problems and of programs administered by the U.S. Geological Survey in the Department of the Interior.

Drought Assistance. In 1992 the governors of 14 states joined 4 tribal officials in requesting temporary drought assistance under the Reclamation States Emergency Drought Relief Act of 1991. The Bureau of Reclamation maintains Water Conservation and Advisory Centers in regional offices and in Washington, D.C., headquarters to coordinate water conservation programs with the states. In 1992 the bureau took the following measures to lessen the impacts of the western drought:

- Administered $25 million designated for use in meeting emergency needs for areas stricken with drought;
- Initiated seven studies requested by water districts to assess the potential to improve efficiency of water-delivery schedules,

- Facilitated water banking and transfers,
- Inventoried available water inactive in reservoir storage as a potential emergency water supply,
- Identified studies needed on drought mitigation and water conservation to maintain crop production and protect the environment;
- Continued climate change research to evaluate probable impacts of drought on reservoir system management in the western United States.

Water and Power. The Army Corps of Engineers manages over 600 water management projects nationwide, and the Bureau of Reclamation, which manages the majority of projects in the West, operates more than 350 reservoirs. These projects manage water resources for irrigation, flood control, hydroelectric power, navigation, municipal and industrial use, fish and wildlife purposes, and recreation. Bureau of Reclamation projects, with a storage capacity of 125 million acre-feet of water, deliver water to 28 million people and 10 million acres of land each year. A total of 52 hydropower plants generate 60 billion kilowatt hours of electricity each year, making the bureau the eleventh largest producer of electric power in the nation.

Water Transfers. Federal water transfers among willing buyers and sellers, in accordance with state law, represent one way to respond to changes in demand for western water supplies without building new storage facilities. The Bureau of Reclamation facilitates trades such as the following, in partnership with the states and other interested parties:

- **Snake River Drainage.** The Bureau of Reclamation and the State of Idaho jointly established three water banks in the Snake River Drainage. Water users with reservoir rights can "deposit" surplus water in the banks, thus making it available to others.
- **Central Valley Project.** On the Friant Unit of the Central Valley Project, water transfers occurred between districts as part of a conjunctive-use program, which manages groundwater and surface water for a common purpose. Southern California water users propose expanding the conjunctive use of Central Valley Project water, and studies are underway to further increase water-use efficiency.
- **Columbia River Basin.** The Bureau of Reclamation traded flood-control storage space with the Army Corps of Engineers to aid salmon migration.
- **Indian Water Rights Settlements.** Water settlements have resolved conflicts between Native American tribes and other persons over title to western water. The Bush administration supported inclusion of leasing in Indian water rights settlements. Examples include Fort Hall, Montana, and Jicarilla, New Mexico. With clear title, Native Americans can lease water to their neighbors, putting water to use or maintaining existing uses. Water leasing precludes the need for new storage construction and allows Native Americans a return for the use of their assets.

Water Quality

The goals of the Clean Water Act are ambitious—fishable, swimmable rivers throughout the nation and zero discharge of pollutants into U.S. waters.

Monitoring Water Quality

To provide water quality information and to coordinate the federal, state, local, and private entities involved, the federal government has formed an Intergovernmental Task Force on Monitoring Water Quality (ITFM). Eight federal and eight state agencies joined to form the 3-year task force, which is chaired by the Environmental Protection Agency and cochaired by the U.S. Geologic Survey. Four task groups are addressing the following topics:

- A nationwide institutional framework to achieve more efficient and effective water resource monitoring;
- Environmental indicators;
- Comparable data collection methods; and
- Data management and more effective information sharing.

The task force is recommending a nationwide coordinated monitoring strategy with national overviews and regional implementation. The strategy will link individual efforts into a comprehensive nationwide effort to support effective decisionmaking.

The act requires all municipal sewage and industrial wastewater to be treated to reduce or remove pollutants before being discharged into waterways, and it provides federal grants and capitalization of state revolving loan funds to help communities build sewage treatment plants. EPA, in cooperation with the states, establishes limits on the amounts of specific pollutants that may be discharged by municipal sewage treatment plants and industrial facilities, based on available technologies and economic costs of compliance.

National Pollution Discharge Elimination System. Under the Clean Water Act, EPA or approved states administer the National Pollutant Discharge Elimination System (NPDES). EPA or approved states issue permits that establish effluent limits for all municipal and industrial dischargers. The federal government currently authorizes 38 states and one territory to operate the NPDES permit program. In addition to technology-based limits, EPA may develop limits based on water quality criteria where technology-based controls are not stringent enough to make waters safe for such uses as fishing, swimming, and drinking. For industrial dischargers, EPA has established stringent standards to control up to 126 toxic pollutants. Currently, about 50 major industries comply with these standards, which are based on the best available technology that is economically achievable.

EMAP. EPA is developing the Environmental Monitoring and Assessment Program (EMAP) to monitor and assess the ecological health of major ecosystems in an integrated, systematic manner. EMAP will monitor and assess surface waters, forests, near-coastal waters, wetlands, agricultural lands, arid lands, and the Great Lakes. The program will operate at regional and national scales, over a period of decades, to evaluate the extent and con-

dition of entire ecological resources. A 4-year resampling cycle will allow approximately 800 lakes and 800 stream sites to be evaluated annually.

Improving Water Quality in New York Reservoirs. In July 1992 New York City officials and 400 farmers in the Catskill Mountains and lower Hudson River Valley agreed to voluntary measures designed to reduce water pollution from agricultural practices. If successful, these measures could save the City of New York from having to spend $4 billion on a new filtration system to clean river water. The city's six Catskill and Delaware River reservoirs, which provide drinking water to more than 8 million people, are being contaminated by manure, insecticides, fertilizers, and road runoff from farming areas.

Under the agreement, the city will pay $3.4 million to the state's Soil Conservation Committee that will in turn provide technical assistance to the farmers through Cornell University and other state and local agricultural and environmental groups. Farmers contend that successful implementation of voluntary measures could achieve up to 80-percent compliance with water quality requirements.

Groundwater Quality Protection. To protect groundwater, EPA is implementing a Ground Water Strategy for the 1990s that emphasizes pollution prevention. The strategy draws upon federal environmental laws that control solid and hazardous wastes, pesticides, surface waters, underground storage tanks, and waste cleanup, as well as drinking water. As part of a new Comprehensive State Ground Water Protection Program, the states will integrate all federal and state programs relating to groundwater. EPA has provided $12.2 million to the states to implement the program.

Safe Drinking Water Program. EPA sets standards for drinking water quality and requirements for treatment under the Safe Drinking Water Act (SDWA). Federal standards control both manmade and naturally occurring contaminants, and the Public Water Supply Supervision Program, authorized by SDWA, supervises compliance. In most cases, states have the primary responsibility for oversight and enforcement. EPA supports states through grants and technical assistance and, if necessary, enforces SDWA regulations.

National Water Quality Assessment. The U.S. Geological Survey administers the National Water Quality Assessment Program (NAWQA) to describe the status and trends in the quality of the nation's surface waters and groundwater. Within a 10-year period, NAWQA plans to study the populations served by public water supplies and conduct investigations in 60 study units that will represent 70 percent of the water Americans use. Personnel will use physical, chemical, and biological measures to investigate the occurrence of pesticides, nutrients, and sediments. In 1992 the Geological Survey had NAWQA field investigations underway in 20 study units distributed across the nation. Study units consist of watersheds that range in size from 1,200 to 60,000 square miles. Each study unit has a liaison committee with representatives from federal, state, and local agencies, universities, and the private sector.

Endangered Species Protection. Approximately a third of all federally listed threatened and endangered species rely on aquatic ecosystems. In July 1992 EPA and the U.S. Fish and

Wildlife Service signed a Memorandum of Understanding (MOU) linking Clean Water Act standards to species protection. EPA agreed to an assessment and consultative process to determine whether CWA standards interfere with provisions of the Endangered Species Act. Where adverse impacts are found, EPA could move to alter CWA standards to mitigate impacts.

President's Water Quality Initiative. The U.S. Department of Agriculture has undertaken a major research initiative called the Management System Evaluation Areas (MSEA). The emphasis is on nonpoint-source contamination of ground and surface water by agricultural chemicals. Research results from five study locations in the Midwest will help farmers control and reduce the impact of agrichemicals on water resources. The U.S. Geological Survey is supporting the initiative by conducting geohydrologic studies and research on the fate and transport into groundwater of the pollutants atrazine, carbofuran, alachlor, and nitrate.

National Irrigation Water Quality Program. The Department of the Interior administers this program to investigate irrigation-induced water quality problems in the western states. Reconnaissance investigations check for contamination by trace elements and toxic substances including selenium, mercury, arsenic, and pesticides. In 1992 DOI completed ten investigations, during which waterfowl deformities and

Geographic Targeting and Watershed Management

Geographic targeting focuses not on political boundaries, such as federal regions, states, counties, or municipalities, but on ecological units—estuaries, river basins, corridors, or the critical habitat of a species or group of species. Watershed management is an example of this approach.

In April 1991 EPA identified watershed management as a tool for dealing with problems affecting watersheds selected for special attention. Watershed management honors the interconnectedness of aquatic systems by managing human impact on those systems in an integrated fashion. The objective is to align existing water quality management programs to complement and strengthen the efforts of others, including other federal agencies, state and local governments, and private citizens. This approach shifts the emphasis from particular pollutants or pollution sources to a process that begins with the questions, "What is affecting this watershed? Can the resource and its stressors be managed differently?" In 1992 EPA was involved in watershed projects in the following locations:

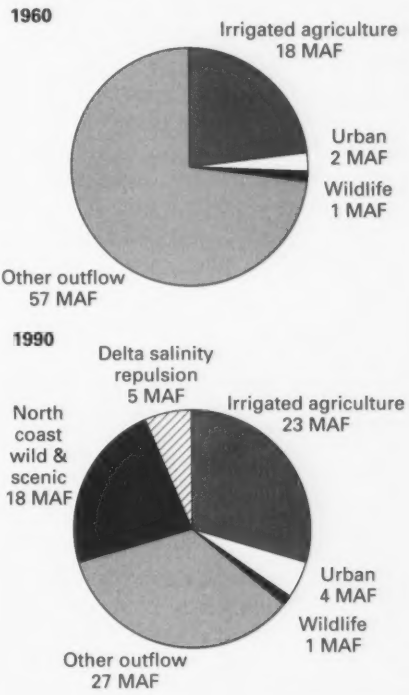
- Anacostia River, Maryland, and the District of Columbia;
- Bear Creek Floatway, Alabama;
- Canaan Valley, West Virginia;
- Elkhorn Slough, California;
- Merrimack River, Massachusetts, and New Hampshire;
- Pequea and Mill Creeks, Pennsylvania; and
- Tomki River, California.

reproductive problems were found at several locations. The Department has published detailed study reports for the Kendrick Reclamation Area in Wyoming and the Stillwater Wildlife Management Area in Nevada.

Nonpoint Source Pollution. Despite progress in improving water quality impacts from industrial and municipal dischargers (point sources), the nation faces significant water quality challenges. The nation's major remaining water pollution problems are caused by less obvious and more widespread sources of pollution—nonpoint sources that affect both surface water and groundwater. These relatively uncontrolled sources of pollution may contribute more to water quality degradation than point sources. Leading nonpoint sources of pollution include agricultural and urban runoff, forestry practices, and hydromodification. In 1992 EPA awarded 52.5 million to the states to assist in the development of nonpoint management programs. In addition, a 1991 survey by the National Association of State Foresters indicated that 32 states have forestry nonpoint source pollution control programs that emphasize prevention through the use of best management practices (BMPs). In 18 states conducting BMP compliance surveys, compliance ranged from 79 percent for streamside management to 98 percent for forest-site preparation.

Combined Sewer Overflow Initiative. Combined sewer overflows (CSOs) occur where sanitary and storm sewers are interconnected. During rainstorms, these systems become overloaded, bypass treatment works, and discharge as much as 90 percent of the pollutants they contain. CSO discharges may contain high levels of suspended solids, bacteria, heavy metals, floatables, nutrients, oxygen-demanding organic compounds, oil and grease and other pollutants. Discharges of these pollutants often exceed state water quality standards. In 1989 EPA issued the National Combined Sewer Overflow Strategy, reaffirming that CSOs are point sources subject to National Pollution Discharge Elimination System (NPDES) permit requirements. NPDES permits are based on technology-based and water-quality-based requirements of the Clean Water Act. In 1991 EPA

Disposition of annual runoff in California.



Note: 1960 and preliminary 1990 data for a total of 78 million acre feet (MAF).

Source: State of California, Department of Water Resources, Sacramento, CA, 1992.

launched an initiative targeting those CSO systems causing the most severe water quality problems. EPA will issue new or revised permits to CSO systems lacking or having inadequate discharge permits and plans enforcement actions against systems in violation of permit limits.

Mexican Border Initiative. In February 1992 the United States and Mexico adopted a multimedia plan to address environmental problems along their common border. The plan includes construction of international wastewater treatment facilities, provision of safe drinking water, conducting joint monitoring and enforcement, and providing technical assistance and training to Mexico. The two nations have begun technical assistance and training; they plan joint monitoring in 1993 along the Rio Grande River and propose monitoring of groundwater for the Nogales and El Paso areas. Construction continues on the Tijuana international wastewater facility as do negotiations toward international agreements for wastewater facilities to serve Nogales and the area of Mexicali/Calexico. In 1993 numerous U.S. agencies will coordinate efforts to provide over $85 million in grants and loans to Mexican communities or colonias across the border from Texas and New Mexico.

Wetlands

Also see Agriculture, Forestry, Water, and related tables and figures in Part II.

Wetlands are critical ecological systems. An estimated 80 percent of the nation's coastal fisheries and one-third of the nation's endangered species depend on wetlands for spawning, nursery areas, and food sources. Wetlands are home to millions of waterfowl and other birds, plants, mammals, and reptiles. Wetlands also perform hydrologic functions. Serving as recharge areas, they help protect the quantity and quality of the nation's groundwater. Unaltered wetlands in a flood plain can reduce flood peaks by 80 percent, and their natural water filtration and sediment control capabilities help maintain water quality.

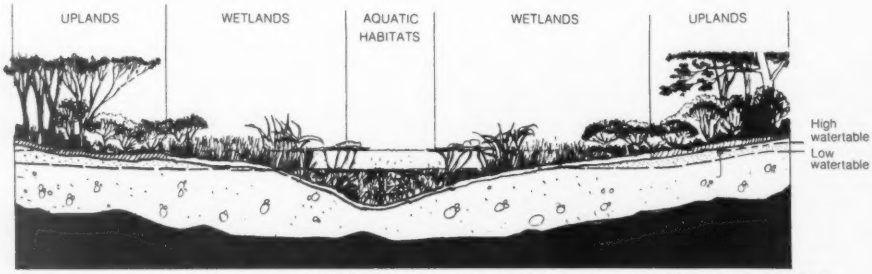
Wetlands are also vital to commercial and recreational sectors of the economy, such as the sports fishing and waterfowl hunting industries. In addition, the diversity of plant and animal life in wetlands make them a valuable resource for nonconsumptive fish and wildlife-related recreation. Wetlands provide educational and research opportunities and a variety of historical and archaeological values.

Conditions and Trends

More than half of the wetlands that existed in what is now the lower 48 states have been converted to other uses; several states have lost 80 percent or more of their wetlands. Estimated annual wetlands losses between the mid-1950s and the mid-1970s stand at 458,000 acres. Between the mid-1970s and the mid-1980s, estimated losses ranged from 120,000 to 290,000 acres per year. Loss estimates for nonfederal rural wetlands in the 1982-1991 period showed a further reduction. According to the Natural Resources Inventory issued by the Soil Conservation Service, annual wetlands loss rates in nonfederal rural areas outside Alaska fell from 131,000 acres during 1982-1987 to 108,000 acres during 1987-1992. The reductions are attributable to enforcement of the Swampbuster provisions of the 1985 and 1990 farm bills.

Because loss figures can be confusing, federal agencies—for purposes of inventory—consider lands cleared of native wetlands vegetation as converted

Identifying features of wetlands.



Source: Council on Environmental Quality, *Environmental Trends,* (Washington, DC: CEQ, 1989), page 97.

to other uses and often do not count them as wetlands. Many of these converted acres, particularly in agricultural areas, may still exhibit wetlands characteristics. If upon discontinuation of cropping, these lands exhibit wetlands soil and hydrologic characteristics and again support wetlands vegetation, they may be considered wetlands for regulatory purposes.

Policies and Programs

In 1992 the U.S. government continued efforts to restore wetlands and reform federal wetlands programs. Federal policy focused largely on implementing the President's August 1991 comprehensive policy statement on wetlands.

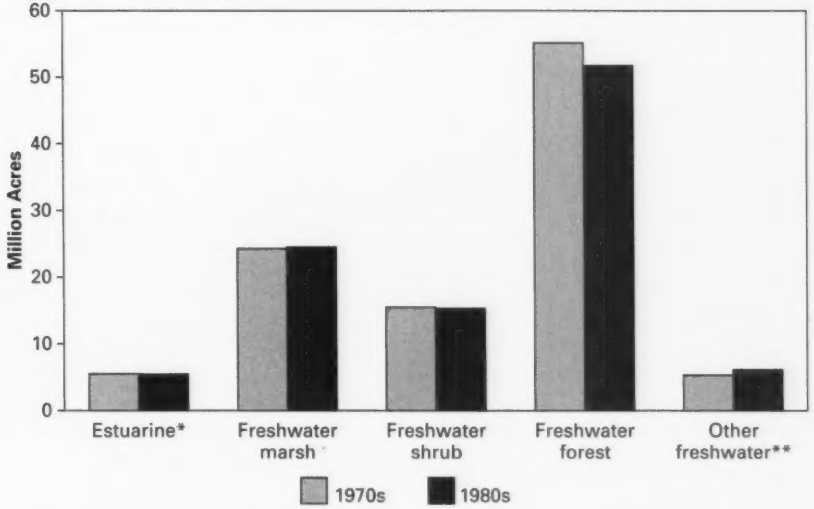
Wetlands Restoration

Federal agencies restore wetlands on their own lands as well as providing technical and financial assistance to state and private landowners. A 1992 interagency report recorded the restoration and enhancement of 282,000 acres of federal wetlands from fiscal 1989 through fiscal 1992. A half million acres of wetlands on nonfederal lands also were restored, primarily with federal technical assistance.

Forest Service. Wetlands restoration, which is common on the national forests, can be a simple matter, as the following example demonstrates. During road construction on the Cibola National Forest in New Mexico, workmen uncovered a road culvert that had been installed below ground. The culvert had lowered the water table in an adjacent 3-acre meadow, altering the hydrology of the site and eliminating wetlands plant species. By installing an elbow on the inlet of the culvert, Forest Service staff were able to reestablish the original drainage, and the higher water table promoted the return of wetlands species to the meadow. Cost to the Forest Service was $75, and labor contributed by the Wild Turkey Foundation came to $120.

Bureau of Land Management. BLM developed a national strategy to restore wetlands-associated wildlife habitat on 20 million acres through cooperative public-private efforts. For example, in Idaho, BLM worked with Ducks Unlimited and the Idaho Department of Fish and Game to construct 11 miles of fence to enhance waterfowl nesting and breeding habitat along the

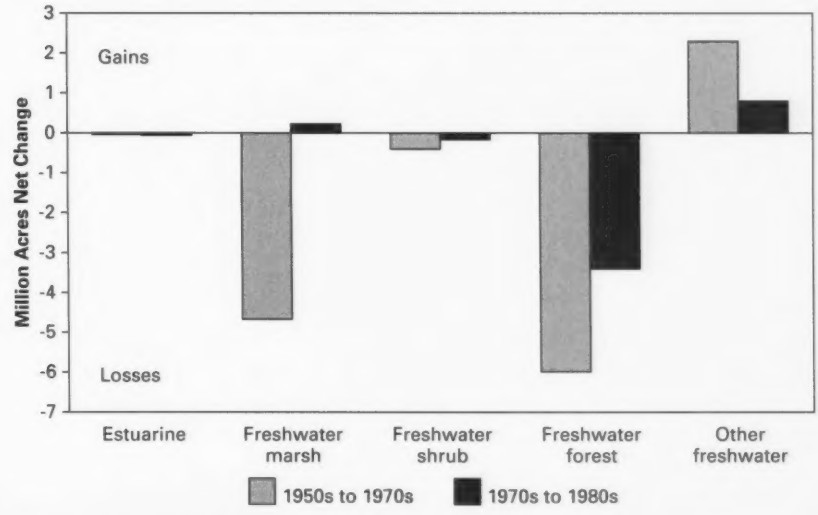
U.S. wetlands distribution, by type.



* Includes unconsolidated shore, rocky shore, aquatic bed, forested, shrub, and intertidal emergent wetlands—brackish and saltwater.
** Includes freshwater shores, beaches, bars, open water, ponds, and floating aquatic or submerged vegetation.

Source: See Part II, Table 63.

U.S. wetlands gains and losses, by type.



Source: See Part II, Table 63.

Agricultural Wetlands Reserves

The Agricultural Wetlands Reserve Program is a new, permanent-easement program created by the 1990 Farm Bill. The program, administered by the Department of Agriculture, is authorized to purchase permanent wetlands easements on up to 1 million acres of farmland over five years and to pay up to 75 percent of restoration costs. While budget requests were in line with the 1 million-acre target, the Congress began with $46 million for a 50,000-acre pilot program in fiscal 1992. During the initial sign-up period, U.S. farmers attempted to enroll a total of nearly 500,000 acres of wetlands in conservation easements in the following nine states:

State	Acres offered
California	85,000
Iowa	45,000
Louisiana	119,000
Minnesota	33,000
Missouri	29,000
Mississippi	115,000
New York	2,000
North Carolina	25,000
Wisconsin	13,000
Total	**466,000**

South Fork and Henry's Fork of the Snake River. The Thousand Spring/Chilly Slough area was selected by the North American Wetlands Conservation Council to receive a $125,000 grant to acquire adjacent wetlands habitat, and The Nature Conservancy transferred to the State of Idaho 18 acres of headwater spring crucial to the management and protection of this key waterfowl habitat area.

Conservation Reserve Program. Through the Conservation Reserve Program (CRP), designed to protect highly erodible cropland, the Department of Agriculture protects wetlands by means of 10-year contracts and provides assistance for wetlands restoration efforts. To date, 400,000 acres of wetlands have been enrolled in CRP. Upon expiration of these 10-year contracts, current CRP wetlands could be returned to active cropping, or they could qualify for enrollment in the Agricultural Wetlands Reserve.

North American Waterfowl Management Plan

The North American Waterfowl Management Plan provides an umbrella for activities of many federal agencies and for federal partnerships with public and private groups. Partners include the governments of the United States, Canada, and Mexico, 50 states, 10 provinces, and more than 250 conservation groups. Between 1986 and 1991, more than 250 wetlands conservation partnerships implemented habitat protection, restoration, and enhancement projects benefiting over 1 million acres

of wetlands and associated habitats. Estimated 1992 accomplishments include 60,000 acres restored, 140,000 acres enhanced, and 210,000 acres protected.

Partners for Wildlife

The Fish and Wildlife Service provides technical and financial assistance to private landowners, through a Partners for Wildlife program. To date, the agency, working with private partners, has helped restore 177,000 acres through voluntary agreements with 9,000 landowners. In 1992 alone FWS helped restore 37,400 acres through voluntary agreements with 2,000 landowners.

Managing Riparian Areas

Given their relatively small acreages, riparian values and benefits are considerable. In the arid western United States, riparian areas are among the most productive ecosystems on public lands, but, over the years, many of these areas have deteriorated. Since riparian benefits cannot be fully realized under degraded conditions, public concern is growing over the condition of these areas, particularly in the western states.

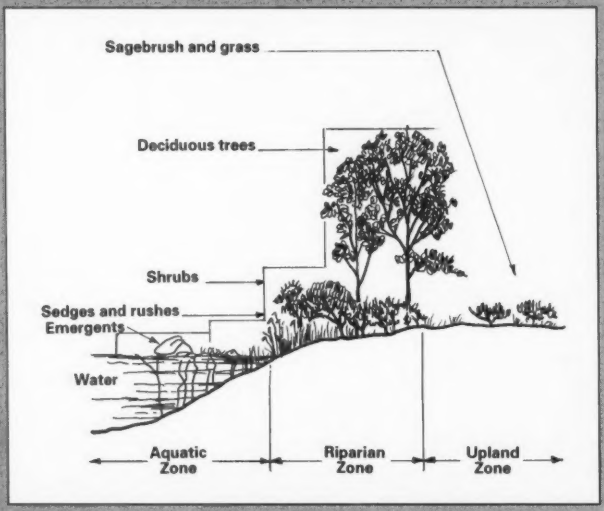
Forest Service. The National Forest System contains 5.6 million acres of riparian ecosystems along 359,000 miles of streams, rivers, and shorelines. In 1990 only 42 percent of these riparian areas met standards set by forest plans. Based on inventories of over 400,000 acres of riparian ecosystems, the Forest Service developed a number of restoration plans for the future. The goal of the agency's Riparian Strategy is to complete forest-wide inventories of riparian conditions and ecological health by the year 1995. In 1991 the Forest Service issued the report, *Riparian Management, A Leadership Challenge*, with guidelines for restoring riparian areas and wetlands throughout the National Forest System and for assuring that healthy riparian areas are not degraded by human activities. The goal is to meet standards set by national forest plans on 75 percent of unsatisfactory riparian areas by the year 2000.

Over the past three years, the Forest Service has restored 22,000 acres of riparian areas on the Lassen, Plumas, Six Rivers, Cleveland, and Mendocino forests in the Southwest. Restoration techniques include meadow rehabilitation, channel and bank stabilization, road obliteration, mine rehabilitation, and gully restoration. The following groups have assisted with these efforts: California Department of Fish and Game, California Department of Forestry, California Conservation Corps, Youth Conservation Corps, Los Angeles County Parks and Recreation Department, local landowners, and national forest permit holders.

Bureau of Land Management. Riparian areas constitute 23.7 million acres or 8.8 percent of the 270 million acres of BLM lands. In an effort to restore, enhance, and protect these areas, BLM has undertaken a Riparian-Wetlands Initiative for the 1990s. With a goal of restoring 75 percent of BLM riparian areas by 1997, BLM has implemented 680 new on-site projects. Among these are new fence construction to improve grazing management, tree planting, and the use of prescribed fire. A total of 530 maintenance projects are upgrading deteriorated fences, water developments, and habitat-improvement structures. The bureau is conducting inventories on thousands of miles of riparian streams to determine

What Is a Riparian Area?

The green area immediately adjacent to streams, rivers, and lakes—known as a riparian area—is identified by the presence of vegetation that requires large amounts of free or unbound water.



Healthy riparian areas can provide the following benefits:

- Produce more forage than uplands, resulting in higher livestock-weaning weights;
- Shelter livestock during weather extremes;
- Reduce flood velocities and bank erosion, minimizing property loss;
- Stabilize streambanks with dense vegetation that reduces damage from animal trampling, ice scouring, and erosive flood waters;
- Increase late-summer streamflows for irrigation, stockwater, and fisheries by recharging underground aquifers and providing bank water storage;
- Filter sediment, protecting water quality, prolonging irrigation pump life, and reducing siltation of ponds and irrigation ditches;
- Improve wildlife habitat by providing food, water, and cover;
- Improve fisheries by providing food, cool water, and cover;
- Provide recreation sites for picnics and camping.

Source: U.S. Department of the Interior, Bureau of Land Management, *Riparian-Wetland Initiative for the 1990's,* (Washington, DC: DOI/BLM, September 1990), page 3.

their condition and potential for recovery. Examples of cooperative efforts follow.

- **Marys River.** Ranchers, local residents, and conservation groups are working together to improve riparian management on the Marys River in Nevada. As a part of this effort, 54 miles of stream critical to the threatened Lahontan cutthroat trout were acquired through a land exchange between BLM and private owners.
- **Trout Creek.** The Trout Creek area of Southeast Oregon is a 190,000-acre watershed with about 175 miles of stream. Due to poor livestock management practices, much of the watershed was in degraded condition. BLM, local ranchers, Oregon Trout, the Oregon Environmental Council, the Izaac Walton League of America, and others developed a rotational grazing system to give the degraded areas periodic rest from the grazing of 2,000 head of cattle.
- **Cedar Creek.** Cedar Creek in Northern California is an 8 1/2 mile stream on private land surrounded by a 60,000-acre watershed managed primarily by BLM. BLM, landowners and ranchers, the Alturas Riparian Steering Committee, The Nature Conservancy, and others are cooperating to protect and enhance upland and riparian-wetlands areas. Techniques include improved grazing management, prescribed burning to control sagebrush and juniper, and planting of willows, cottonwoods, aspen, and sedges.

Coastal America Saltmarsh Restoration

The Intermodal Surface Transportation Efficiency Act (ISTEA) allows federal-aid highway funds to be used for wetlands mitigation and conservation. In July 1992 the interagency Coastal America partnership, as one of its projects, signed agreements to restore ecologically valuable saltmarshes along the Connecticut coastline. These marshes have been cut off from tidal flow since rail and road corridors were developed along the coastline in the early twentieth century. The Coastal America partnership involves the Connecticut departments of Transportation and Environmental Protection, U.S. Environmental Protection Agency, Army Corps of Engineers, and departments of Transportation and Commerce. The agencies agreed to identify appropriate candidate sites and cooperate on restoration activities. For more information on Coastal America, see the Coasts and Oceans section.

Aquatic Ecosystems Restoration Strategy

A committee of the National Research Council (NRC) recommended in 1992 that a national aquatic ecosystems restoration strategy be developed for the nation, to accomplish, over the next 20 years, restoration of the following:

- 2 million acres of lakes,
- 400,000 miles of river-riparian systems, and
- 10 million acres of wetlands, largely through reconverting crop and pastureland and modifying or removing water-control structures. The committee recommended this as a net gain—that is, 10 million acres over and above losses of wetlands from other activities.

Coastal Wetlands Conservation

The Coastal Wetlands Planning, Protection, and Restoration Act of 1990 created a National Coastal Wetlands

Conservation Grants Program for state coastal conservation efforts. In 1992 a total of 13 projects received $5.7 million in federal funding under this grants program.

The President's Wetlands Plan

In August 1991 President Bush delivered a comprehensive policy statement on wetlands, which included the following major elements:

- Develop a new federal wetlands delineation manual,
- Strengthen nonregulatory programs, and
- Strengthen and streamline the Clean Water Act section 404 regulatory program.

An update on efforts by federal agencies to implement the President's wetlands policy follows.

Wetlands Delineation Manual. In 1992 EPA and the departments of the Interior, Agriculture, and Army continued work on revising the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*. Prior to 1989 federal agencies had no common delineation method; some used different techniques in different areas of the country. For example, the 1987 *Wetlands Delineation Manual* of the Army Corps of Engineers (COE) was not binding upon COE staff conducting delineations, and thus its use was inconsistent. An interagency manual prepared in 1989 became the subject of intense controversy and led, in August 1991, to a proposed revision. In response to that proposal, federal agencies received over 76,000 comments from the public. In 1992 deliberations

Wetlands Acquisitions

In 1992 federal acquisitions of key wetlands continued under a variety of programs. Federal agencies purchased a total of nearly 133,000 acres, using various funding sources led by the Land and Water Conservation Fund for 49,196 acres and the Migratory Bird Conservation Fund for 83,746 acres. Examples of wetlands acquisitions follow.

Agency	Project	Location	Acreage
NOAA	ACE Basin NERR	North Carolina	3,408
NOAA	North Carolina NERR	North Carolina	45
NOAA	Sapelo Island NERR	Georgia	206
FWS	Morgan Brake NWR	Mississippi	3,897
FWS	Grasslands WMA	California	6,129
FWS	Deep Fork NWR	Oklahoma	6,805
FWS	Bogue Chitto NWR	Louisiana	2,476
FWS	Waterfowl Production Areas	North Central United States	63,159

NOAA = National Oceanic and Atmospheric Administration, U.S Department of Commerce
NERR = National Estuarine Research Reserve
FWS = Fish and Wildlife Service, U.S. Department of the Interior
NWR = National Wildlife Refuge
WMA = Wildlife Management Area

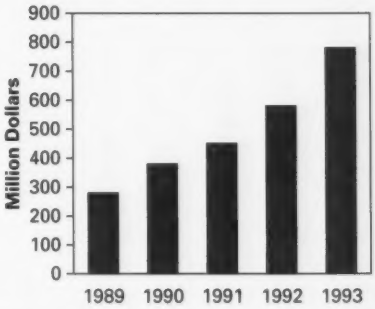
continued on these comments and on options for proceeding. In the meantime, the Congress directed the Army Corps of Engineers to resume using its 1987 manual for implementation of the section 404 Clean Water Act regulatory program. The Department of Agriculture continued to rely on the National Food Security Act Manual to implement Swampbuster and other wetlands provisions of the 1985 and 1990 farm bills.

Nonregulatory Programs. The President's policy statement included elements to strengthen acquisition and other nonregulatory programs that protect wetlands, in many cases through better coordination of existing programs.

- **National Restoration Program.** President Bush called for a government-wide wetlands restoration and creation program on federal lands. The Interagency Committee on Wetlands Restoration and Creation, created to fulfill this mandate, completed its report, *A National Program For Wetlands Restoration and Creation,* in August 1992. The committee recommended long- and short-term objectives, consistent with a recent National Research Council (NRC) report on restoration of aquatic ecosystems. The committee provided criteria for project selection and made the following recommendations:
  - Restoration on 1.3 million acres by 1995 (200,000 acres of federal and 1.1 million acres of nonfederal lands) as a step toward achieving a net gain of 10 million acres of wetlands on federal and nonfederal land by 2010.
  - Voluntary federally assisted measures on nonfederal lands, since approximately 90 percent of restorable wetlands are on state and private lands;
  - Initial focus on wetlands restoration rather than creation, since restoration has a higher likelihood of success;
  - Uniform definitions and reporting standards; and
  - A limited-term federal-state-private National Wetlands Restoration Council to coordinate restoration, enhancement, and creation activities.

  The NRC report also recommended a single coordinating entity.
- **Inventory.** Because many federal programs collect information on wetlands, the objectives of the following programs ensure efficient and comparable inventory data.
  - A long-term effort is underway to assess the feasibility of coordinating and integrating the National Wetlands Inventory, conducted by the Fish and Wildlife Service, with the USDA National Resources Inventory, which includes resources in addition to wetlands, uses different methods, and covers only rural, nonfederal lands.
  - In 1992 the interagency Federal Geographic Data Committee recom-

Wetlands funding.



Note: Funding supports wetlands research, regulation, enforcement, and acquisition.

Source: Office of Management and Budget, *Budget of the United States,* (Washington, DC: Government Printing Office, 1992-1993).

C. Butcher.

A public-private partnership is working to restore the Florida Everglades, an invaluable wetlands resource.

mended updating and distributing a report on federal coastal wetlands mapping programs prepared by the Fish and Wildlife Service and the National Oceanic and Atmospheric Administration. The report describes the technologies used in federal mapping efforts.

– In 1992 the federal agencies undertaking inventory efforts (USDA, DOI, NOAA, and EPA) agreed to use a common wetlands classification/identification scheme—the Cowardin system—to provide consistency in describing wetlands.

• **Research.** The Federal Coordinating Committee on Science, Engineering, and Technology (FCCSET) established a Subcommittee on Wetlands Research to define research responsibilities and identify areas where future research could support wetlands programs and coordinate wetlands research. The subcommittee produced an inventory of federal wetlands research efforts.

Regulatory Streamlining. The third element of the President's wetlands plan was to improve and streamline the section 404 regulatory program of the Clean Water Act. In pursuit of this goal, federal agencies undertook the following activities in 1992:

• **Project Management.** COE issued a Regulatory Guidance Letter (RGL) clarifying its decisionmaking role for the evaluation of permits in the section 404 program. The guidance is aimed at improving coordination between federal agencies and applicants in requesting information, providing comments, and developing permit conditions.

• **Permit Review.** In late summer 1992 the federal government revised interagency agreements among COE, EPA, and the National Marine Fisheries Service. Developed under section 404(q) of the Clean Water Act, these agreements allow for orderly resolution of disputes between the Corps, which issues section 404 per-

mits, and the principal agencies that review permits. Procedures governing elevation of permit decisions for higher level review are a principal component of the agreements. The revisions differ from past section 404(q) interagency agreements by limiting elevation of specific permit cases to those applications affecting aquatic resources of national significance.

• **Regulation of Prior Converted Cropland.** The Army Corps of Engineers and EPA proposed regulations that would incorporate into section 404 regulations existing Corps guidance providing that "prior converted" croplands are not within the scope of the section 404 program. Prior converted croplands are areas that were converted mostly through drainage prior to passage of Swampbuster provisions in the 1985 farm bill.

• **Outreach and Public Information.** In an effort to clarify the federal wetlands program and improve communication with the agriculture community, the Department of Agriculture, EPA, and COE developed six fact sheets on issues relating to wetlands and agriculture. Additional brochures and other materials are being developed. To increase private stewardship of wetlands, EPA expanded its Wetlands Hotline (1-800-832-7828), which distributed publications, to include information on voluntary public and private assistance programs available to private landowners.

• **Transportation and the Section 404 Program.** The Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA) will provide billions of dollars for improvements to the nation's transportation infrastructure. To ensure that these projects receive appropriate, expeditious environmental review, the secretary of Transportation, the EPA administrator, and the assistant secretary of the Army for Civil Works signed a joint memorandum to senior regional managers for each agency. The memo emphasized the need for improved coordination, innovative and cost-effective approaches, and to the extent practical, integration of section 404 alternative analyses with those conducted under the National Environmental Policy Act. It also included 13 specific action items or commitments and provided headquarters contacts to resolve issues that cannot be addressed quickly in the field.

• **Alaskan Wetlands.** In October 1992 the Bush administration proposed a rule change, using the process known as sequencing to remove the requirement that section 404 permits in Alaska be subject to review. Sequencing requires applicants first to avoid all negative impacts; second, to minimize unavoidable impacts; and finally, to compensate for remaining impacts with mitigation measures—usually restoration or creation of wetlands—preferably on or near the site. In place of sequencing, applicants would need only to demonstrate that they had minimized impacts. In proposing the rule, EPA requested comments on approaches—including retention of sequencing—for protecting areas defined as high-value wetlands by the state of Alaska.

PART II: Environmental Data and Trends

Data Collection and Analysis

The Council on Environmental Quality (CEQ) is required by law to "gather timely and authoritative information concerning the conditions and trends in the quality of the environment . . . [and] to analyze and interpret such information . . ." Collecting data to determine environmental conditions and trends is essential for making and evaluating national environmental policy. Reliable information also helps define the long-term health of the ecosystems and identify potential causes of environmental degradation.

Data in this section are intended to provide information to help answer basic questions about the status and condition of the environment:

- Are environmental conditions getting better or worse?
- Have environmental legislation and regulatory programs resulted in measurable environmental improvements?
- In what areas have changes been most noticeable?
- What is the cost of specific environmental improvements?

Environmental Data Programs

Part II of the Presidents *Environmental Quality* report begins with two tables that describe federal data collection and analysis programs. These tables indicate that the federal government conducts many environmental and natural resource data programs. In a recent summary, the Environmental Protection Agency identified 83 environmental data programs in 25 different federal agencies.

Given the scope and diversity of available data, many experts see the need for an overarching framework to assess linkages among environmental stresses, the state of the environment, and policy responses.

A comprehensive and integrated framework for environmental trends reporting is being developed under the auspices of the Interagency Committee on Environmental Trends (ICET). Convened in 1991 by CEQ, the committee has set as its goal the development of an ongoing process of data exchange and environmental reporting among existing

programs. An interagency team conducted a similar exercise in 1989 that resulted in the award-winning *Environmental Trends*, a comprehensive state-of-the-environment report with over 350 tables and figures reflecting conditions and variations in environmental quality. ICET plans to develop another comprehensive state-of-the-environment report by 1994.

Guide to Usage of Part II

As a step in developing an integrated reporting framework, tables 1-100 in Part II contain cross-references to link pertinent information in one category to indicators in other categories. These cross-references noted at the end of each table are designed to serve as qualitative linkages to assist readers in exploring the relationships among activities, stresses, and environmental resources.

The editors compiled data predominately from federal government agencies, although sources also include authoritative nonfederal programs or the literature of relevant disciplines. Data from federal sources are subject to agency-prescribed standards of quality assurance, and ICET members and other experts at relevant federal agencies reviewed and verified data for the tables and figures. The editors selected national data wherever possible, using state or regional breakdowns where they were especially meaningful and appropriate. Tables and figures represent the most recently available data; however in some cases a delay of a year or more exists between data collection and final reporting. Sources listed with the tables provide additional information regarding the statistical properties or interpretation of data.

Federal interagency initiatives to coordinate environmental data and analysis.

Program	Lead Agency	Coverage
Interagency Committee on Environmental Trends	CEQ	In 1991 CEQ established an interagency committee with the participation of all agencies involved in environmental data to undertake development of a framework for U.S. state-of-the-environment reporting.
National Acid Precipitation Assessment Program 1990 (NAPAP)	CEQ	NAPAP, established by the 1980 Acid Precipitation Act, coordinates federally funded research and assessment to develop a firm scientific basis for acid rain policies. The Clean Air Act Amendments of 1990 extended NAPAP, which monitors the influence of the Clean Air Act on environmental impacts.
Environmental Monitoring and Assessment Program (EMAP)	EPA	A long-term research, monitoring, and assessment program, initiated in 1988 to provide regional and national reports on the conditions of U.S. ecological resources. During the next five years, EMAP monitoring networks will estimate trends in national ecological indicators on a regional basis; monitor selected indicators of natural and anthropogenic stresses; seek associations between human-induced stresses and ecological conditions and provide periodic statistical summaries and interpretive reports on status and trends for resource managers and the public.
EPA Center for Environmental Statistics	EPA	EPA Development Staff established the Center for Environmental Statistics to gather environmental data from a variety of sources; address data quality and statistical issues; and use data to provide information on environmental conditions. The Center currently is situated within the EPA Environmental Statistics and Information Division.
Intergovern-mental Monitoring Task Force	EPA and USGS	Established in 1991 by the EPA Office of Water and the USGS. The task force coordinates efforts with NOAA, FWS, COE, USDA, OMB, and DOE to identify and recommend solutions to water quality monitoring problems; establish a national framework for water quality monitoring; agree on environmental indicators; and share water quality data through system linkages and increased quality assurance and control.

continued

Federal interagency initiatives to coordinate environmental data and analysis. (continued)

Program	Lead Agency	Coverage
Federal Geographic Data Committee (FGDC)	DOI	FGDC, with 14 departments and agencies promotes coordinated development, use, and dissemination of surveying, mapping, and related spatial data. Established by OMB Circular A-16, "Coordination of Surveying, Mapping, and Related Spatial Data Activities," the committee stresses coordination and standards.
Ocean Pollution Data and Information Network (OPDIN)	NOAA	A 10-year interagency effort by 11 federal agencies to improve accessibility and usefulness of data and to increase communication and coordination on ocean and Great Lakes pollution information; the network publishes information guides and responds to requests for information.
FCCSET/CEES IWGDMGC	OSTP	Within the President's Office of Science and Technology Policy (OSTP), the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) established the Committee on Earth and Environmental Sciences (CEES) as a forum to coordinate interagency programs, including the U.S. Global Change Research Program (USGCRP). Chaired by NASA and NOAA, the Interagency Working Group on Data Management for Global Change (IWGDMGC) is developing recommendations on interagency management of research data. In 1991 the National Research Council drafted a "U.S. Strategy for Global Change Data and Information Management."
President's Water Quality Initiative	USDA	This initiative addresses nonpoint source contamination of surface water and groundwater by agricultural chemicals: 11 agencies, including TVA, USGS, EPA, NOAA, FWS, and COE, comprise the working group on the Water Quality. Cooperative programs include the USDA Management Systems Evaluation Areas, the USGS National Water Quality Assessment, and the EPA Midwest Agrichemical Surface/ Subsurface Transport and Effects Research project.

continued

Federal interagency initiatives to coordinate environmental data and analysis. (continued)

Program	Lead Agency	Coverage
Water Information Coordination Program (WICP)	USGS	OMB Memorandum M-92-01 of December 10, 1991, established the Water Information Coordination Program to include all federal organizations that fund, collect, or use water resources information. WICP convenes an Interagency Coordinating Committee for Water Information and a Federal Advisory Committee on Water Data for Public Use. The program is establishing effective working relationships with state and local agencies, Indian tribes, and the private sector. WICP will plan, design, and operate a cost-effective national network for water-data collection; develop uniform standards for water information collection, management, and dissemination; establish a National Water Information Clearinghouse; and annually report to OMB to document funding and program activities.
National Resources Inventory (NRI)	USDA Soil Conservation Service	This national multi-resource inventory is conducted every 5 years to determine status, condition, and trends of soil, water, and related resources. NRI and associated soils data are used to formulate policy and assist in strategic planning of conservation and environmental programs at national, regional, and local levels.
Forest Health Monitoring Program	USDA Forest Service	This long-term monitoring program was started in 1990 to measure, interpret, and report effects of forest pests, air pollution, other stressors, and management methods on the health of U.S. forests. The program included 14 states in 1992 and will be expanded nationwide in future years. It has three increasingly intensive phases: detection monitoring to determine annual differences from baseline conditions or trends; in-depth evaluation monitoring to determine cause, extent, and severity of detected changes; and intensive-site ecosystem monitoring to provide detailed, long-term research data for predicting future conditions. Cooperators include EPA, the National Association of State Foresters, and other state and federal resource agencies.

continued

Federal interagency initiatives to coordinate environmental data and analysis. (continued)

Note: The following abbreviations appear in the environmental data tables:

BLM	=	Bureau of Land Management, Department of Interior
CEQ	=	President's Council on Environmental Quality
COE	=	U.S. Department of Defense, Army Corps of Engineers
DOC	=	U.S. Department of Commerce
DOE	=	U.S. Department of Energy
DOI	=	U.S. Department of the Interior
EC	=	European Community
EPA	=	U.S. Environmental Protection Agency
FAO	=	United Nations Food and Agriculture Organization
FWS	=	Fish and Wildlife Service, Department of the Interior
NASA	=	National Aeronautics and Space Administration
NOAA	=	National Oceanic and Atmospheric Administration, Department of Commerce
OMB	=	President's Office of Management and Budget
OSTP	=	President's Office of Science and Technology Policy
RPA	=	Forest and Rangeland Renewable Natural Resources Policy Act
USDA	=	U.S. Department of Agriculture
USGS	=	U.S. Geological Survey, Department of the Interior

Environmental statistics programs managed by agencies of the U.S. Government.

Program	Sponsor	Coverage	Frequency/ Most Recent Report
Major Uses of Land in the United States	USDA Economic Research Service	Estimated acreage and inventories of major U.S. land uses and of cropland used for crops.	Intervals of major land uses coincide with the Census of Agriculture; 1991 report with 1987 data. Annual reports for cropland used for crops; 1992 report with preliminary 1992 data.
Agricultural Chemical Usage Statistics	USDA National Agricultural Statistics Service and Economic Research Service	Estimated treated acreage and application quantity of fertilizer nutrients and pesticide ingredients applied to field crops, vegetables, and fruits; includes state estimates for those states where the commodities are predominantly produced.	Annual collection for field crops; 1992 report with 1991 data. Biennial reports for vegetables and fruits; 1991 report for vegetables with 1990 data and 1992 report for fruits with 1991 data.
Pollution Abatement Control Expenditures (PAC)	DOC Bureau of Economic Analysis	Summary of all spending for PAC by business, government, and consumers, and by type.	Annual reports; 1992 report with 1990 data.
Energy and Environmental Database	DOC Bureau of the Census, Center for Economic Studies (CES)	Census Bureau and EPA data files have been integrated, yielding longitudinal plant and firm level data on production inputs, outputs, costs, energy consumption, pollution emissions, and pollution abatement expenditures.	Annual collection
Forest Insect and Disease Conditions in the United States	USDA Forest Service	Data for U.S. federal, state, and private forestlands; data analyses by region, ownership, type of insect/ disease, area affected, trend data available.	Annual collection; 1992 report with 1991 data.

continued

Environmental statistics programs managed by agencies of the U.S. Government. (continued)

Program	Sponsor	Coverage	Frequency/ Most Recent Report
RPA Assessment of the Forest and Rangeland Situation	USDA Forest Service	Inventory with trend information on extent, condition, ownership, and composition of U.S. forests; wildlife habitat, forage production, and other resource characteristics.	5-year cycle; 1989 reports with 1987 data.
Land Areas of the National Forest System	USDA Forest Service	Data on extent and characteristics of forest, range, and related lands in the National Forest System.	Annual reports.
Tree Planting in the United States	USDA Forest Service	Summary of tree planting in the United States.	Annual reports; 1992 report with 1991 data.
Survey of Pollution Abatement Costs and Expenditures	DOC Bureau of the Census	Annual operating costs and capital expenditures for pollution abatement activities in manufacturing industries.	Annual collection.
Classified Shellfishing Waters	NOAA	Monitors classified shellfishing waters as indicators of bacterial water quality nationwide; classifies waters for commercial harvest of oysters, clams, and mussels based on actual or potential pollution sources and coliform bacteria levels in surface waters.	5-year surveys; most recent 1990.
Fisheries Statistics Program	NOAA	National compilation, analysis, and dissemination of biological, economic, and sociological statistics from U.S. commercial (domestic and high seas) and recreational fisheries. Mostly marine; historical time series, some dating back to 1800s; some world (FAO, EC) fishery data, foreign nation data on fisheries in U.S. waters. Data types include landings, prices and fishing efforts; number of vessels, gear and fishermen; annual processed products; trade in fisheries products;	Collect daily/ monthly/yearly information from primary and secondary sources; monthly, quarterly, and annual publications; user requests via hard copy, magnetic tapes, diskettes, CD-ROM, PC Bulletin Board.

continued

Environmental statistics programs managed by agencies of the U.S. Government. (continued)

Program	Sponsor	Coverage	Frequency/ Most Recent Report
Fisheries Statistics Program (cont'd)		species composition; length frequencies; per capita consumption; and aquaculture.	
National Climatic Data Center (NCDC)	NOAA	NCDC collects, processes, archives, and disseminates worldwide meteorological and climatological data from a global network of stations; coverage is global, land and sea, primarily of U.S. dependencies, especially for summarized data.	Responds to over 33,000 user requests per year; these records date from mid-nineteenth century to present.
National Oceanographic Data Center (NODC)	NOAA	NODC collects, processes archives, and disseminates such worldwide oceanographic data as marine biology, marine pollution, wind and waves, surface and subsurface currents, and temperature.	Responds to over 10,000 user requests per year; records date from late-nineteenth century to present.
National Geophysical Data Center (NGDC)	NOAA	NGDC collects, processes, archives, and disseminates such worldwide geophysical data as solid earth geophysics, earthquake seismology, geomagnetic surveys, marine geology and geophysics, solar-terrestrial physics, and glaciology.	Responds to 11,000 user requests per year; records date from mid-nineteenth century to present.
National Coastal Pollutant Discharge Inventory Program	NOAA	Compiles pollutant-loading estimates for point, nonpoint, and riverine sources in coastal counties or the 200-mile Exclusive Economic Zone. Such sources discharge to the estuarine, coastal, and oceanic waters of the contiguous United States, excluding the Great Lakes.	East, West and Gulf Coast estimates are for 1982, 1984, and 1987 respectively. In 1993 estimates will be updated to 1991 for all three marine coasts.
National Estuarine Inventory	NOAA	Compiles, evaluates, and assesses information on 102 estuaries in the continental United States, including data on salinity, bottom sediments, freshwater inflow, pesticide use, land use, distribution of	Many projects are ongoing assessments; others involve a snapshot view of existing data. Topics of the

continued

Environmental statistics programs managed by agencies of the U.S. Government. (continued)

Program	Sponsor	Coverage	Frequency/ Most Recent Report
National Estuarine Inventory (cont'd)		estuarine fishes and invertebrates,population, water quality, recreation use, and wetlands.	Coastal Trends series include a summary report on U.S. estuaries (1990), coastal wetlands (1991), housing starts (1992), coastal pollution (expected 1993), oil spills (expected 1993).
Month and State Current Emissions Trends	DOE Argonne National Laboratory	Emissions estimates for NOx, SO2, and VOCs by month and state from 1975 to the present for 68 emission source groups.	Monthly; 1975 to present.
National Energy Information Center	DOE Information Administration	Collects and publishes data; prepares analyses on energy production, consumption, prices, and resources; makes projections of energy supply and demand.	Annual reports.
Carbon Dioxide Information Analysis Center	DOE Oak Ridge National Laboratory	Compiles, evaluates, and distributes information related to carbon dioxide.	Data collection ranges from hourly to decadal.
Integrated Data Base Program	DOE	Maintains data on all spent radioactive fuel and waste in the United States.	Annual data collection and reporting.
National Wetlands Inventory	FWS	Develops comprehensive information on the characteristics and extent of U.S. wetlands resources; wetlands map coverage for 70% of lower 48 states, 22% of Alaska, and all of Hawaii, Puerto Rico, and Guam.	Continuous wetlands trend for lower 48 states; statistical estimates of U.S. wetlands acreage beginning in 1990.
Gap Analysis	FWS	Develops standardized distribution maps of surface vegetation, terrestrial vertebrates, and endangered species in the lower 48 states and Hawaii.	First analysis, 1988 national assessment to be completed in 1998, to be updated at 5-year intervals.

continued

Environmental statistics programs managed by agencies of the U.S. Government. (continued)

Program	Sponsor	Coverage	Frequency/ Most Recent Report
National Contaminant Biomonitoring Program	FWS	Documents temporal and geographic trends in concentrations of persistent environmental contaminants that may threaten fish and wildlife; covers major U.S. rivers and Great Lakes.	2-to-4 year intervals.
North American Breeding Bird Survey	FWS	Provides uniform basis for assessing long-term trends in avian populations throughout North America; total number of individuals by species, survey route, and state.	2-year intervals.
Waterfowl Breeding Population and Habitat	FWS	Provides annual breeding population estimates; measures breeding habitat changes over major portion of duck breeding range in North America.	Annual surveys and reports.
Statistics and Information Services	Bureau of Mines	Collects, analyzes, and publishes data on metal production and consumption, including scrap and waste.	Monthly, quarterly, and annually.
Public Land Statistics	BLM	Collects summary statistics of land ownership in the United States and BLM natural resource management programs at the state level.	Annual reports.
National Stream Quality Accounting Network (NASQAN) and National Hydrologic Benchmark Network	USGS	NASQAN provides a national uniform basis for assessing large-scale, long-term trends in physical, chemical, and biological characteristics of waters; monitors for pH, alkalinity, sulfate, nitrate, phosphorus, calcium, magnesium, sodium, potassium, chloride, suspended sediment, fecal coliform bacteria, fecal streptococcal bacteria, dissolved oxygen, dissolved oxygen deficit, and trace elements; the Benchmark Network monitors water quality in surface waters largely unaffected by human activities.	Yearly data summaries for each state.

continued

Environmental statistics programs managed by agencies of the U.S. Government. (continued)

Program	Sponsor	Coverage	Frequency/ Most Recent Report
National Trends Network	USGS	Monitors atmospheric deposition under National Acid Precipitation Assessment Program (NAPAP); 150 stations predominantly in rural areas, in combination with USDA National Atmospheric Deposition Program (NADP); almost 200 sites nationwide.	NAPAP publications.
National Water Conditions Reporting System	USGS	Collects and analyzes streamflow data, groundwater levels, reservoir contents, and limited water-quality data from 5 sites on major rivers.	Published in monthly newsletter, *National Water Conditions.*
National Land Use and Cover Program	USGS	Includes land-use and land-cover maps and digitized data. Statistics by political units, hydrologic units, and census county subdivisions are available. Classes include urban or built-up land, agricultural land, rangeland, forestland, water areas, wetland, barren land, tundra, and perennial snow and ice. Maps are available for most of the country at 1:250,000 scale.	USGS publications.
Water Data Program	USGS	Nearly 60,000 water-data stations throughout the nation are used to obtain records on stream-flow, stage (height), reservoir and lake stage and storage, groundwater levels, well and spring discharge, and quality of surface water and groundwater. Data, stored in the WATSTORE database, are available in machine readable form or as computer printed tables or graphs, statistical analyses, and digital plots.	Published by water year for each state.
National Water Use Information Program	USGS	Determines purposes for U.S. fresh and saline surface water and groundwater withdrawn, water consumed during use; and water returned to source after use.	National compilations every 5 years; most recent.

continued

Environmental statistics programs managed by agencies of the U.S. Government. (continued)

Program	Sponsor	Coverage	Frequency/ Most Recent Report
Water Resources Assessment Program	USGS	Summarizes statistics on state and national water resources for USGS biennial report, *National Water Summary*; each report oriented to water resource theme, such as groundwater quality.	Biennial; 1991 report covered floods and droughts.
Earth Observing System	NASA	Measures key environmental variables using series of unmanned satellites; part of NASA *Mission to Planet Earth* program; EODIS, its data and information system, will coordinate with the Global Change Data and Information System, which includes the NOAA data and information system.	NASA publications.
National Air Pollution Control Program	EPA Office of Air Quality Planning and Standards	Collects and analyzes data on ambient air quality and air pollution levels and compares them to National Ambient Air Quality Standards (NAAQS).	Annual reports on air quality and emission estimates.
Comprehensive Environmental Response, Compensation, and Liability Information System	EPA Office of Emergency and Remedial Response	Contains information on over 30,000 abandoned or uncontrolled hazardous waste sites.	Updated on-line.
Environmental Radiation Ambient Monitoring System (ERAMS)	EPA Office of Radiation Programs	Monitors radiation in air, drinking water, surface water, and milk.	Sampling intervals from twice weekly to bi-annual, based on analyses, at 332 stations; since 1973.
Hazardous and Nonhazardous Surveys	EPA Office of Solid Waste	Collect data through survey and regulated entity reports on hazardous and non-hazardous (solid) wastes generation and management; information on regulated entities and the waste volumes they generate and manage.	Current data is from 1985 biennial report and two 1986 surveys.

continued

Environmental statistics programs managed by agencies of the U.S. Government. (continued)

Program	Sponsor	Coverage	Frequency/ Most Recent Report
Toxics Release Inventory	EPA Office of Toxic Substances	Mandatory annual inventory of releases of 328 toxic chemicals to air, water, land, and off-site disposal from more than 17,000 manufacturing facilities across the country. Material is available on CD-ROM.	Annual reports.
Water Pollution Control Act Section 305 (b) Assessments	EPA Office of Water	Compiles state reports on water quality status of surface water and groundwater, as required by section 305 (b), Federal Water Pollution Control Act; the states prepare assessments using various monitoring data.	1990 biennial report as of 1988.
Ambient Water Monitoring Program/ STORET	EPA Office of Water	Largest database for water quality information; data contained in STORET with over 170 million data points from states and federal agencies, such as USGS, on surface water and groundwater quality, sediments, streamflow, and fish tissue contamination.	Updated on-line.
Public Water System Supervision Program	EPA Office of Water	Contains information about public water supplies (PWSs) and their compliance with monitoring requirements, maximum contaminant level (MCL) regulations, and other requirements of the Safe Drinking Water Act; data is stored in the Federal Reporting Data System.	Quarterly state and EPA regional reports.
National Pollutant Discharge Elimination System Program	EPA Office of Water	Tracks permit compliance and enforcement status of facilities covered by water pollution permits; information is contained in the Permit Compliance System. (PCS)	Monthly facility reports entered on an ongoing basis.
Municipal Construction Program	EPA Office of Water	Inventory of existing or proposed publicly owned treatment works (POTWs) that need construction or renovation to meet Clean Water Act requirements; information is maintained in the Needs Survey System.	2-year update from each state; biennial report submitted to the Congress.

continued

Environmental statistics programs managed by agencies of the U.S. Government. (continued)

Program	Sponsor	Coverage	Frequency/ Most Recent Report
Coastal and Ocean Protection Programs	EPA Office of Water	Covers environmental data (water quality, biological, permitting, environmental impact data) for discharges and pollutant loadings to coastal waters as well as ocean dumping; information contained in Ocean Data Evaluation System (ODES).	Biennial reports to the Congress for National Estuary Program; annual reports to the Ocean Dumping Program; special reports on coastal programs.

Note: Neither this table nor the source document, which describes 72 federal programs, are exhaustive. For instance, USDA also maintains mission-oriented statistics in such areas as crops, snowpack, soil erosion, national forests management, and wildfires. The DOC Bureau of Census maintains social, demographic, and economic statistics relevant to the environment. NOAA maintains statistics on marine resources and coastal wetlands. BLM maintains statistics for BLM lands, including condition, wildlife, minerals, and use; and NPS collects comparable statistics on the status of national parks. The Bureau of Mines collects, interprets, and publishes data on production, consumption, and trade of over 100 minerals. FWS maintains data on FWS lands and conducts surveys of fishing, hunting, and wildlife-associated recreation every 5 years, with the most recent report in 1991. USGS maps national land use and land cover, and EPA conducts regional and other pollution surveys. DOT compiles highway and other transportation statistics, and the U.S. Coast Guard maintains data on marine pollution spills.

Source: U.S. Environmental Protection Agency, Center for Environmental Statistics, *Guide to Selected National Environmental Statistics in the U.S. Government (draft)*, (Washington, DC: EPA, 1992).

LIST OF TABLES AND FIGURES

Tables

Population

Table 1 Total population and population growth rate, 1900-1992. 273
Table 2. Components of total population change, 1940-1991. 274
Table 3. Age structure of the population, including Armed Forces overseas, 1940-1991. 274
Table 4. Population in urban, suburban, and rural areas, 1950-1990. 275
Table 5. Net population migration, by region, 1960-1991. 275
Table 6. Population density, 1940-1990. 276

Economy and the Environment

Table 7. Gross domestic product, 1959-1992. 280
Table 8. Pollution abatement and control expenditures, 1972-1990. 281
Table 9. Pollution abatement expenditures, by type of pollution, 1981-1990. 282
Table 10. Pollution abatement and control expenditures, by sector, 1972-1990. 283
Table 11. Pollution abatement expenditures, by selected industries, 1973-1991. 284
Table 12. U.S. government outlays, by function and superfunction, 1962-1992. 291
Table 13. State and local government expenditures on the environment, 1959-1990. 294

Energy

Table 14. U.S. energy reserves, by source, 1977-1990. 298
Table 15. U.S. energy production, by source, 1950-1991. 299
Table 16. U.S. coal production, by rank and mining method, 1950-1991. 300
Table 17. U.S. petroleum production and imports, 1940-1991. 301
Table 18. U.S. natural gas production, 1900-1991. 302
Table 19. U.S. production of electricity, by energy source, 1950-1991. 303
Table 20. U.S. nuclear energy production, 1957-1991. 304
Table 21. Net U.S. energy imports, by source, 1950-1991. 305
Table 22. U.S. energy consumption, by end-use sector, 1950-1991. 306
Table 23. U.S. energy consumption, per capita, 1950-1991. 307
Table 24. U.S. energy consumption, per dollar of GDP, 1959-1991. 308
Table 25. Industrial and residential energy consumption, 1960-1990. 309
Table 26. Energy expenditure estimates, by sector, 1970-1990. 310

Water

Table 27. Precipitation index for the United States and western United States, 1896-1992. 316
Table 28. Severe to extreme drought and wetness in the conterminous United States, 1896-1992. 317
Table 29. Offstream water use, by source and end-use sector, 1900-1990. 318
Table 30. Designated-use support in surface waters of the United States, 1990. 319
Table 31. Causes and sources of pollution in surface waters of the United States,1990. 320
Table 32. National ambient water quality in rivers and streams: violation rates, 1975-1989. 321
Table 33. Trends in stream water quality, 1978-1987. 322
Table 34. Estimated phosphorus loadings to the Great Lakes, 1976-1989. 323
Table 35. Shellfish bed closures, by region, 1966-1990. 324
Table 36. Sea level trends for selected coastal areas in the United States, 1930-1980. 324

Air Quality

Table 37. U.S. emissions of six major air pollutants, by source, 1970-1991. 331
Table 38. U.S. emissions of carbon dioxide, from anthropogenic sources, 1950-1990. 335
Table 39. Concentration of cations and anions in precipitation in the eastern and western United States, 1985-1991. 336
Table 40. National ambient concentrations of criteria air pollutants, 1975-1991. 337
Table 41. Concentrations of carbon dioxide above U.S. monitoring stations, 1973-1991. 338
Table 42. Air quality trends in major urban areas, 1980-1991. 339
Table 43. Persons living in counties with air quality levels above National Ambient Air Quality Standards, 1984-1991. 340
Table 44. U.S. average air temperature, 1901-1987. 341

Land, Agriculture, and Forestry

Table 45. Land use and ownership in the United States, 1900-1987. 349
Table 46. Special uses of land in the United States, 1949-1987. 350
Table 47. Number of farms and land in farms, 1900-1987. 350
Table 48. Major uses of cropland, 1945-1992. 351
Table 49. Cropland acreages harvested for export and domestic uses, 1950-1990. 352
Table 50. Soil erosion on nonfederal agricultural lands, 1977-1987. 353
Table 51. Agricultural productivity indexes, 1950-1990. 354
Table 52. Farm fuel use, 1974-1991. 355

Table 53. Farm fertilizer use, 1940-1992. 356
Table 54. Farm pesticide use, 1964-1992. 357
Table 55. Irrigated farmland, 1900-1992. 358
Table 56. Condition of nonfederal rangeland, 1963-1987, and Bureau of Land Management rangeland, 1936-1991. 359
Table 57. Timberland in the United States, by ownership, 1952-1987. 360
Table 58. Annual growth and removal of timber stocks, 1952-1986, and volume of timber stocks, 1952-1987. 360
Table 59. Roundwood production, by major product, 1950-1990. 361
Table 60. Roundwood consumption, by major product, 1900-1988. 362
Table 61. Forest fire damage and tree planting, 1930-1991. 363
Table 62. Forestland damaged by insects, 1968-1991. 364
Table 63. Wetlands losses, by type, 1970s-1980s. 365
Table 64. Wetlands losses, by state, 1780s-1980s. 365
Table 65. Coastal wetlands distribution, by region and habitat, 1980s. 367

Protected Lands

Table 66. National Park System, 1872-1992. 370
Table 67. National Wildlife Refuge System, 1920-1992. 370
Table 68. National Forest System, 1891-1991. 370
Table 69. National Wilderness Preservation System, 1964-1991. 371
Table 70. National Wild and Scenic River System, 1968-1992. 371
Table 71. National Estuarine Research Reserves and National Marine Sanctuaries, 1975-1992. 372
Table 72. National Register of Historic Places, 1967-1992. 372
Table 73. Distribution of protected areas within selected federal lands, 1991. 373
Table 74. Visits to areas administered by federal agencies, 1977-1991. 374

Wildlife and Fisheries

Table 75. Trends in selected resident and neotropical migrant birds, 1966-1991 386
Table 76. Contaminant levels in starlings, 1968-1985. 388
Table 77. Contaminant levels in herring gull eggs from Great Lakes colonies, 1974-1991. 389
Table 78. Duck population estimates, 1955-1992. 392
Table 79. Goose and swan population estimates, 1970-1992. 393
Table 80. Contaminant levels in waterfowl, by flyway, 1966-1985. 394
Table 81. Fishing and hunting in the United States, 1955-1991. 395
Table 82. Contaminant levels in fall run coho salmon from the Great Lakes, 1980-1988. 396
Table 83. Contaminant levels in freshwater fish, 1971-1984. 396
Table 84. Commercial harvest of selected marine and estuarine fisheries, 1950-1991. 397
Table 85. Marine recreational fisheries catch, 1979-1991. 398
Table 86. Status of fisheries, marine mammals, and sea turtles in U.S. waters, 1991. 399

Table 87. Threatened and endangered U.S. wildlife and plants, 1980-1992. 402

Transportation

Table 88. Personal travel and fuel consumption, 1969-1991. 406
Table 89. Personal travel, per household, driver, and mode, 1969, 1977, 1983, and 1990. 407

Environmental Hazards and Human Health Risks

Table 90. Municipal solid waste, 1960-1990. 412
Table 91. Municipal solid waste generation and recovery, by waste type, 1960-1990. 413
Table 92. Accumulated volume and radioactivity of nuclear waste, 1963-1990. 414
Table 93. CERCLIS and NPL sites, 1980-1992..... 415
Table 94. U.S. production of synthetic organic chemical products, 1969-1990. 416
Table 95. Environmental distribution of TRI releases and transfers, 1987-1990. 417
Table 96. Environmental distribution of TRI releases and transfers, by industry, 1987-1990. 418
Table 97. Oil spills in and around U.S. waters, 1970-1990. 421
Table 98 Waterborne disease outbreaks, by type of water supply system, 1971-1990. 422
Table 99. Shellfish-borne disease outbreaks, by etiologic agent, 1973-1987. 423
Table 100. Pesticide residues in domestic foods, by commodity group, 1978-1991. 424

Figures

Population

Figure 1. Aging of the U.S. population, 1940-1991. 271
Figure 2. Urban, suburban, and rural population of the United States, 1950-1990. 271
Figure 3. Population migration, by region, 1960-1990. 272
Figure 4. Population density, 1940-1990. 272

Economy and the Environment

Figure 5a. Pollution abatement expenditures, by type of pollution, 1981-1990. 278
Figure 5b. Pollution abatement expenditures, by sector, 1972-1990. 278
Figure 6. Pollution abatement capital expenditures by major U.S. industries, 1973-1991. 279

Figure 7. State and local government expenditures on the environment, 1960-1990. 279

Energy

Figure 8. U.S. reserves of crude oil and natural gas, 1977-1990. 296
Figure 9. U.S. energy production, by source, 1960-1991. 296
Figure 10. Net U.S. imports of energy, 1960-1991. 297
Figure 11. Industrial and residential energy consumption, 1960-1990. 297

Water

Figure 12a. Precipitation index for the United States, 1896-1992. 312
Figure 12b. Precipitation index for the western United States, 1896-1992. 312
Figure 13a. Severe to extreme drought in the conterminous United States, 1896-1992. 313
Figure 13b. Severe to extreme wetness in the conterminous United States, 1896-1992. 313
Figure 14a. National water conditions hydrologic areas. 314
Figure 14b. Monthly departure of actual streamflow (1985-1992) from median streamflow (1951-1980). 314

Air Quality

Figure 15a. U.S. emissions of particulates, by source, 1970-1991. 326
Figure 15b. U.S. emissions of sulfur oxides, by source, 1970-1991. 326
Figure 15c. U.S. emissions of nitrogen oxides, by source, 1970-1991. 327
Figure 15d. U.S. emissions of volatile organic compounds, by source, 1970-1991. 327
Figure 15e. U.S. emissions of carbon monoxide, by source, 1970-1991. 328
Figure 15f. U.S. emissions of lead, by source, 1970-1991. 328
Figure 16a. National ambient concentrations of particulates, 1975-1991. 329
Figure 16b. National ambient concentrations of sulfur dioxide, 1975-1991. 329
Figure 16c. National ambient concentrations of nitrogen dioxide, 1975-1991. 329
Figure 16d. National ambient concentrations of ozone, 1975-1991. 329
Figure 16e. National ambient concentrations of carbon monoxide, 1975-1991. 329
Figure 16f. National ambient concentrations of lead, 1975-1991. 329
Figure 17. U.S. emissions of carbon dioxide, from anthropogenic sources, 1950-1990. 330
Figure 18. U.S. average air temperature, 1901-1987. 330

Land, Agriculture, and Forestry

Figure 19. Land use in the United States, 1900-1987. 343
Figure 20. Special uses of land, 1949-1987. 343
Figure 21a. Number of farms in the United States, by farm size, 1900-1987. 344
Figure 21b. Land in farms in the United States, by farm size, 1900-1987. 344

Figure 22. Cropland acreages harvested for export and domestic uses, 1950-1990. 345
Figure 23. Irrigated farmland, 1900-1992. 345
Figure 24a. Condition of nonfederal rangeland, 1963-1987. 346
Figure 24b. Condition of Bureau of Land Management rangeland, 1936-1991. 346
Figure 25. Timberland in the United States, by ownership, 1952-1987. 347
Figure 26. Net growth of U.S. timber stocks, 1952-1986. 347
Figure 27. Volume of timber stocks in the United States, 1952-1987. 348
Figure 28. Roundwood consumption in the United States, 1900-1988. 348

Protected Lands

Figure 29. Visits to selected federal lands, 1977-1991. 369

Wildlife and Fisheries

Figure 30. Trends in selected neotropical migrant bird populations, 1982-1991. 376
Figure 31. DDE in herring gull eggs from Great Lakes colonies, 1977-1991. 377
Figure 32. PCBs in herring gull eggs from Great Lakes colonies, 1977-1991. 378
Figure 33a. Breeding population estimates for northern pintail and mallard, 1955-1992. 379
Figure 33b. Breeding population estimates for green-winged teal and scaup, 1955-1992. 379
Figure 33c. Breeding population estimates for gadwall and blue-winged teal, 1955-1992. 379
Figure 33d. Breeding population estimates for American widgeon and northern shoveler, 1955-1992. 379
Figure 33e. Breeding population estimates for canvasback and redhead, 1955-1992. 379
Figure 33f. Population estimates for Canada goose and Snow goose, 1970-1992. 379
Figure 34. DDE in waterfowl, by flyway, 1966-1984. 380
Figure 35. Fishing and hunting in the United States, 1955-1991. 381
Figure 36a. DDT in fall run coho salmon from the Great Lakes, 1980-1988. 383
Figure 36b. PCBs in fall run coho salmon from the Great Lakes, 1980-1988. 383
Figure 37. Commercial harvest of selected marine and estuarine fisheries in U.S. waters, 1950-1991. 384
Figure 38a. Status of Atlantic and Gulf of Mexico marine mammals, 1991. 385
Figure 38b. Status of Pacific marine mammals, 1991. 385
Figure 38c. Status of female sea turtles that nest on U.S. beaches, 1991. 385

Transportation

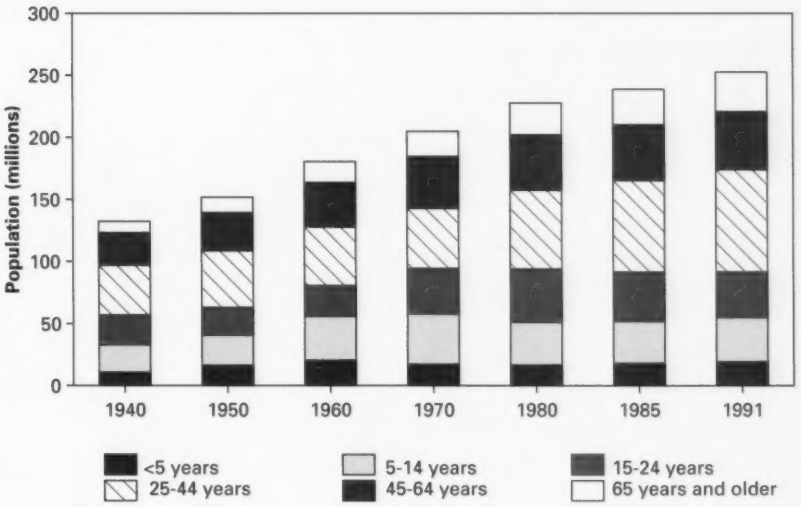
Figure 39. Characteristics of personal travel, 1969, 1977, 1983, and 1990. 404
Figure 40. Average personal vehicle trip length, 1969, 1977, 1983, and 1990. 404
Figure 41. Average commute-to-work trip length, by mode, 1969, 1977, 1983, and 1990. 405
Figure 42. Average annual travel per driver, 1969, 1977, 1983, and 1990. 405

Environmental Hazards and Human Health Risks

Figure 43. U.S. production of selected synthetic organic chemicals, 1969-1990. 409
Figure 44. Environmental distribution of TRI releases, 1987-1990. 410
Figure 45 Environmental distribution of TRI transfers, 1987-1990. 410
Figure 46. TRI releases and transfers, by major U.S. industries, 1987-1990. 411

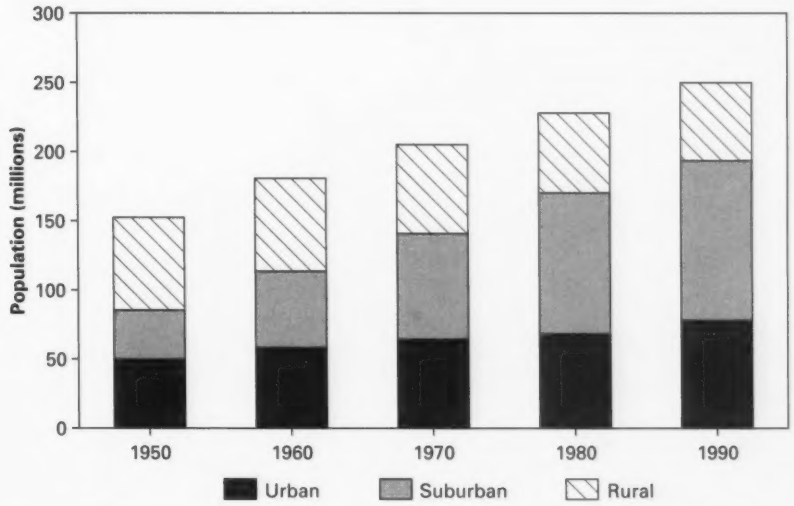
Population

Figure 1.—Aging of the U.S. population, 1940-1991.



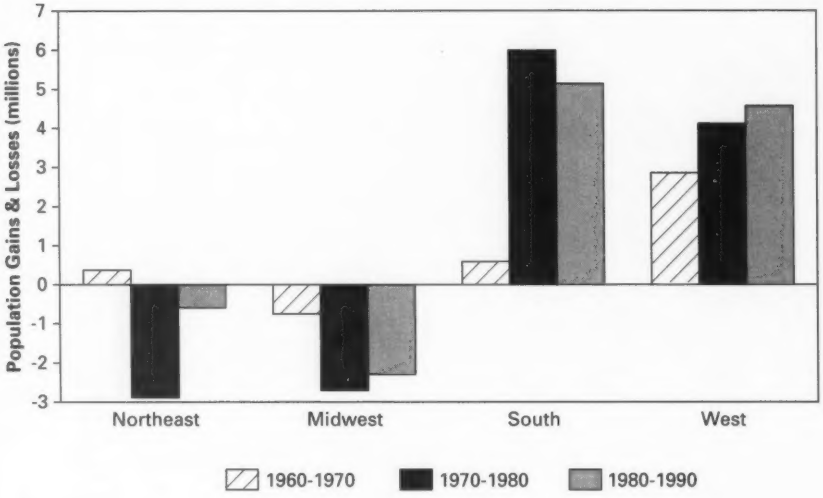
Source: See Table 3.

Figure 2.—Urban, suburban, and rural population of the United States, 1950-1990.



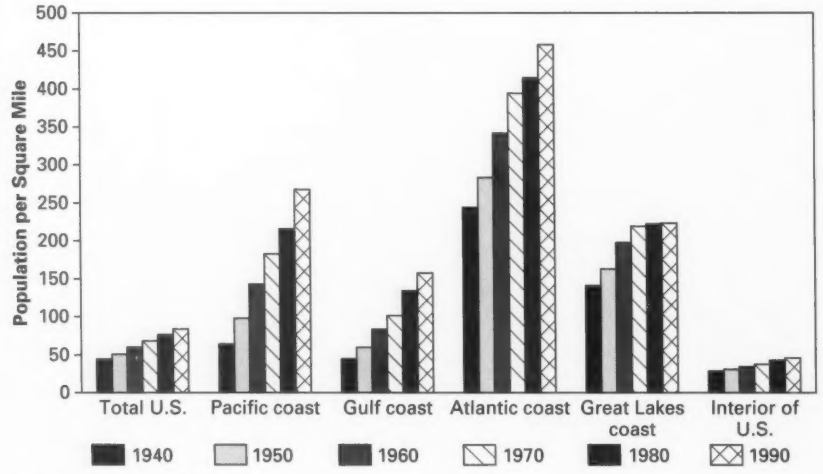
Source: See Table 4.

Figure 3.—Population migration, by region, 1960-1990.



Source: See Table 5.

Figure 4.—Population density, 1940-1990.



Source: See Table 6.

Table 1.—Total population and population growth rate, 1900-1992.

Year	Population	Growth rate	Year	Population	Growth rate	Year	Population	Growth rate
	millions	*%*		*millions*	*%*		*millions*	*%*
1900	76.09	na	1931	124.15	0.7	1962	186.54	1.5
1901	77.58	2.0	1932	124.95	0.6	1963	189.24	1.4
1902	79.16	2.0	1933	125.69	0.6	1964	191.89	1.3
1903	80.63	1.9	1934	126.49	0.7	1965	194.30	1.2
1904	82.17	1.9	1935	127.36	0.7	1966	196.56	1.1
1905	83.82	2.0	1936	128.18	0.6	1967	198.71	1.1
1906	85.45	1.9	1937	128.96	0.7	1968	200.71	1.0
1907	87.01	1.8	1938	129.97	0.8	1969	202.68	1.0
1908	88.71	2.0	1939	131.03	0.8	1970	205.05	1.3
1909	90.49	2.0	1940	132.59	0.9	1971	207.66	1.2
1910	92.41	2.1	1941	133.89	1.0	1972	209.90	1.0
1911	93.86	1.6	1942	135.36	1.3	1973	211.91	0.9
1912	95.34	1.6	1943	137.25	1.3	1974	213.85	0.9
1913	97.23	2.0	1944	138.92	1.2	1975	215.97	1.0
1914	99.11	1.9	1945	140.47	1.0	1976	218.04	1.0
1915	100.55	1.4	1946	141.94	1.5	1977	220.24	1.0
1916	101.96	1.4	1947	144.70	1.8	1978	222.59	1.1
1917	103.41	1.4	1948	147.21	1.7	1979	225.06	1.1
1918	104.55	1.1	1949	149.77	1.7	1980	227.72	1.1
1919	105.06	0.5	1950	152.27	1.7	1981	229.96	1.0
1920	106.46	1.3	1951	154.88	1.7	1982	232.19	1.0
1921	108.54	2.0	1952	157.55	1.7	1983	234.32	0.9
1922	110.05	1.4	1953	160.18	1.7	1984	236.37	0.9
1923	111.95	1.7	1954	163.03	1.8	1985	238.49	0.9
1924	114.11	1.9	1955	165.93	1.8	1986	240.68	0.9
1925	115.83	1.5	1956	168.90	1.8	1987	242.84	0.9
1926	117.40	1.4	1957	171.98	1.7	1988	245.06	0.9
1927	119.04	1.4	1958	174.88	1.7	1989	247.34	0.9
1928	120.51	1.2	1959	177.83	1.7	1990	249.92	1.0
1929	121.77	1.0	1960	180.67	1.6	1991	252.69	1.1
1930	123.19	0.9	1961	183.69	1.6	1992	255.41	1.1

Source: U.S. Department of Commerce, Bureau of the Census, Estimates of the Population of the United States to August 1, 1992. Current Population Reports, series P-25, no. 1091, and earlier reports in this series, (Washington, DC: DOC, September 1992).

Notes: The population estimates shown here are based on the April 1, 1990, population as enumerated in the 1990 census. Estimates for dates prior to April 1, 1990, have been revised. Annual population estimates are as of July 1 for the given year. Total population includes Armed Forces oversees.

Related Tables: 2-6, 23, 88-90.

Table 2.—Components of total population change, 1940-1991.

Year	Births	Deaths	Net civilian immigration	Net change
		millions		
1940	2.570	1.432	0.077	1.221
1945	2.873	1.549	0.162	1.462
1950	3.645	1.468	0.299	2.486
1955	4.128	1.537	0.337	2.925
1960	4.307	1.708	0.328	2.901
1965	3.801	1.830	0.373	2.315
1970	3.739	1.927	0.438	2.617
1975	3.144	1.894	0.449	2.165
1980	3.612	1.990	0.845	2.582
1985	3.761	2.087	0.650	2.325
1991	4.094	2.157	0.866	2.803

Source: U.S. Department of Commerce, Bureau of the Census. U.S. Population Estimates, by Age, Sex, and Race, and Hispanic Origin: 1980-1991, Current Population Reports, series P-25, forthcoming, and earlier reports in this series, (Washington, DC: DOC, 1993).

Related Tables: 1, 3-6, 23, 88-90.

Table 3.—Age structure of the population, including Armed Forces overseas, 1940-1991.

Year	Population, by age class, in years							
	< 5	5-14	15-24	25-34	35-44	45-54	55-64	> 64
	millions							
1940	10.6	22.3	24.0	21.5	18.4	15.6	10.7	9.0
1950	16.3	24.5	22.3	23.9	21.6	17.4	13.4	12.4
1960	20.3	35.7	24.6	22.9	24.2	20.6	15.6	16.7
1970	17.2	40.7	36.5	25.3	23.1	23.3	18.7	20.1
1980	16.5	34.8	42.2	37.6	25.9	22.8	21.8	25.7
1985	17.8	33.7	40.2	41.9	31.8	22.5	22.3	28.4
1991	19.2	35.9	36.6	43.1	39.4	25.7	21.0	31.8

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, series A 30-37, (Washington, DC: DOC, 1976).

U.S. Department of Commerce, Bureau of the Census, U.S. Population Estimates, by Age, Sex, and Race, and Hispanic Origin: 1980-1991, Current Population Reports, series P-25, forthcoming, and earlier reports in this series, (Washington, DC: DOC, 1993).

Note: Annual population estimate are for July 1 of each year.

Related Tables: 1, 2, 4-6, 23, 88-90.

Table 4.—Population in urban, suburban, and rural areas, 1950-1990.

Year	Urban population		Suburban population		Rural population	
	millions	*%*	*millions*	*%*	*millions*	*%*
1950	49.661	32.8	35.193	23.3	66.472	43.9
1960	58.004	32.3	54.881	30.6	66.438	37.0
1970	63.797	31.4	75.621	37.2	63.793	31.4
1980	67.949	30.0	101.481	44.8	57.115	25.2
1990	77.844	31.3	114.882	46.2	55.984	22.5

Source: U.S. Department of Commerce, Bureau of the Census, Population Censuses Number of Inhabitants, U.S. Summary, 1950-1990, (Washington, DC: DOC, 1991).

Notes: Urban population refers to population living inside central cities of Metropolitan Statistical Areas (MSAs). Suburban population refers to population living in MSA suburbs outside central cities. Rural population refers to nonmetropolitan population.

Related Tables: 1-3, 5, 6, 23, 25, 42, 43, 47, 88-90.

Table 5.—Net population migration, by region, 1960-1991.

Region	Gains and losses			
	1960-1970	1970-1980	1980-1990	1990-1991
	millions			
Northeast	0.324	-2.888	-0.592	-0.237
Midwest	-0.752	-2.703	-2.293	0.046
South	0.593	5.992	5.143	0.653
West	2.855	4.115	4.568	0.490

Source: 1960-1970 – U.S. Department of Commerce, Bureau of the Census, Current Population Reports, series P-25, no. 460, (Washington, DC: DOC).

1970-1980 – U.S. Department of Commerce, Bureau of the Census, Current Population Reports, series P-25, no. 957, (Washington, DC: DOC).

1980-1990 – U.S. Department of Commerce, Bureau of the Census, unpublished data (will be superseded in the near future).

1990-1991 – U.S. Department of Commerce, Bureau of the Census, Press Release CB91-346, (Washington, DC: DOC).

Notes: Migration for 1980-1990 is from components of population change used in developing postcensal 1980-based state population estimates. Migration for 1990-1991 is from components of population change used to develop the July 1, 1991, state estimates.

Related Tables: 1-4, 6, 13, 23, 25, 35, 43, 88-90.

Table 6.—Population density, 1940-1990.

Year	Total conterminous United States	Counties in coastal regions				Interior of U.S.
		Pacific	Gulf of Mexico	Atlantic	Great Lakes	
	population per square mile					
1940	44.4	64.1	44.8	244.4	140.9	28.5
1950	50.8	97.6	59.8	283.3	162.9	30.9
1960	60.3	142.7	83.1	341.6	197.3	34.3
1970	68.3	182.5	101.1	394.4	219.1	37.6
1980	76.0	215.8	134.1	414.9	222.4	42.8
1985	79.1	231.5	149.3	429.7	221.4	44.6
1990	83.5	267.6	157.4	458.2	223.4	46.1

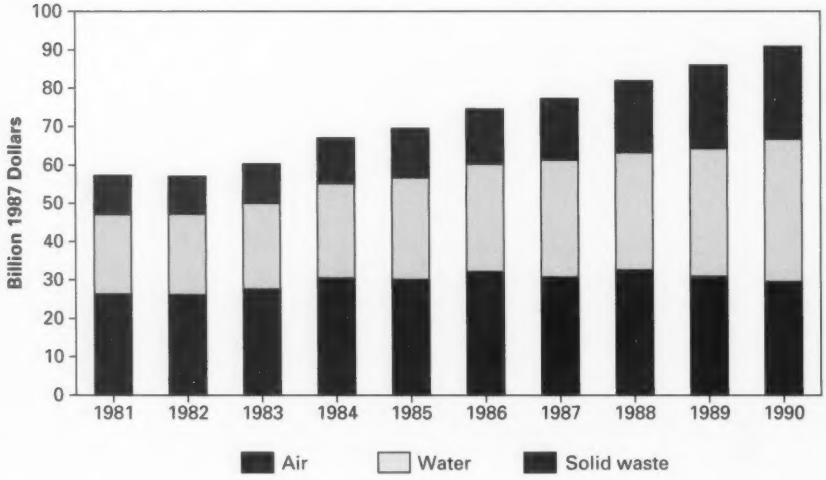
Source: U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, annual, and 1980 and 1990 population censuses, (Washington, DC: DOC).

Note: Coastal area includes 611 counties and independent cities entirely or substantially within 50 miles of the U.S. conterminous coast.

Related Tables: 1-5, 13, 31, 35, 63-65.

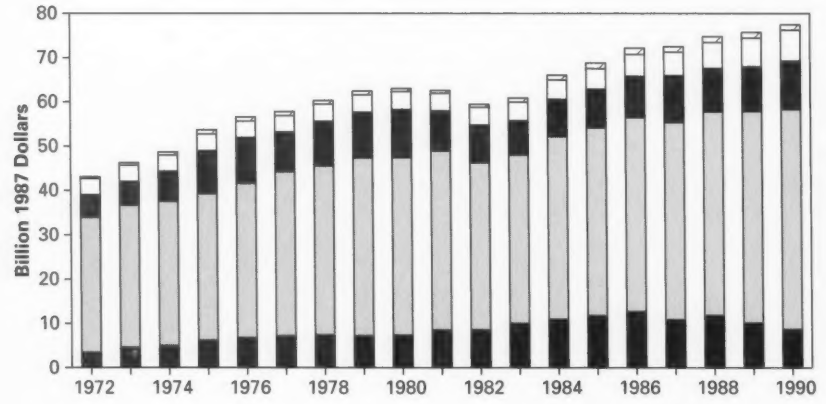
Economy and the Environment

Figure 5a.—Pollution abatement expenditures, by type of pollution, 1981-1990.



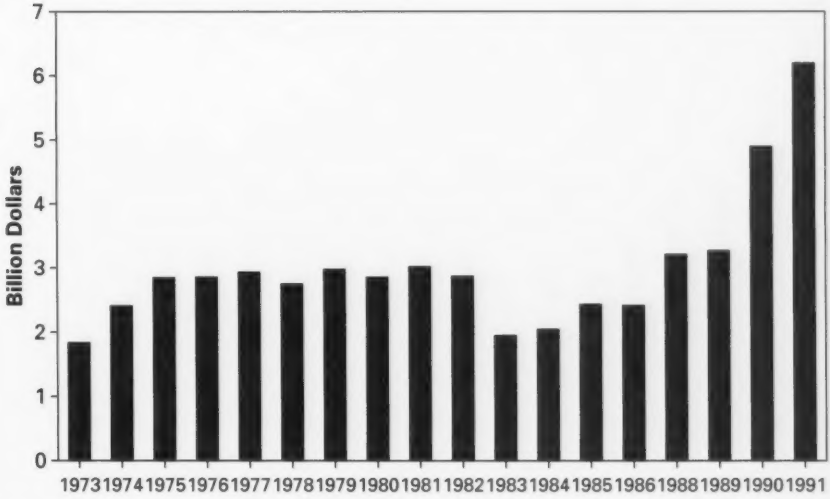
Source: See Table 9.

Figure 5b.—Pollution abatement expenditures, by sector, 1972-1990.



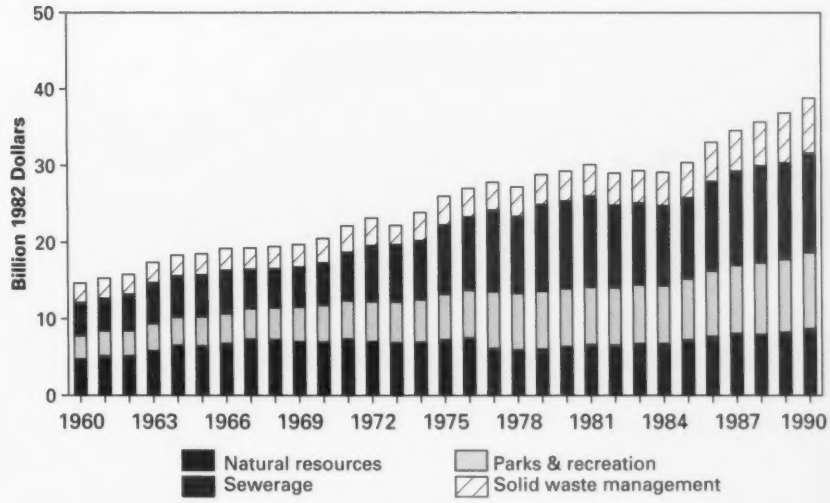
Note: Government purchases=fixed capital for publicly owned electric utilities and public sewer systems.
Source: See Table 10.

Figure 6.—Pollution abatement capital expenditures by major U.S. industries, 1973-1991.



Note: Capital expenditures for all industries listed in Table 11.
Source: See Table 11.

Figure 7.—State and local government expenditures on the environment, 1960-1990.



Source: See Table 13.

Table 7.—Gross domestic product, 1959-1992.

Year	Gross domestic product		Price deflators for GDP
	Current dollars	1987 dollars	
	billion $		*(1987=100)*
1959	494.2	1,931.3	25.6
1960	513.4	1,973.2	26.0
1961	531.8	2,025.6	26.3
1962	571.6	2,129.8	26.8
1963	603.1	2,218.0	27.2
1964	648.0	2,343.3	27.7
1965	702.7	2,473.5	28.4
1966	769.8	2,622.3	29.4
1967	814.3	2,690.3	30.3
1968	889.3	2,801.0	31.7
1969	959.5	2,877.1	33.3
1970	1,010.7	2,875.8	35.1
1971	1,097.2	2,965.1	37.0
1972	1,207.0	3,107.1	38.8
1973	1,349.6	3,268.6	41.3
1974	1,458.6	3,248.1	44.9
1975	1,585.9	3,221.7	49.2
1976	1,768.4	3,380.8	52.3
1977	1,974.1	3,533.2	55.9
1978	2,232.7	3,703.5	60.3
1979	2,488.6	3,796.8	65.5
1980	2,708.0	3,776.3	71.7
1981	3,030.6	3,843.1	78.9
1982	3,149.6	3,760.3	83.8
1983	3,405.0	3,906.6	87.2
1984	3,777.2	4,148.5	91.0
1985	4,038.7	4,279.8	94.4
1986	4,268.6	4,404.5	96.9
1987	4,539.9	4,540.0	100.0
1988	4,900.4	4,718.6	103.9
1989	5,244.0	4,836.9	108.4
1990	5,513.8	4,884.9	112.9
1991	5,671.8	4,848.4	117.0
1992	5,967.1	4,924.5	121.1

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Survey of Current Business, vol. 72, no. 2, (Washington, DC: DOC, 1992).

Executive Office of the President, Council on Economic Advisers, Economic Report of the President, (Washington, DC: GPO, 1992).

Note: The 1992 GDP is estimated for the third quarter of the calendar year.

Related Tables: 8-10, 13, 24, 26.

Table 8.—Pollution abatement and control expenditures, 1972-1990.

Year	Pollution abatement		Regulation & monitoring		Research & development		Total	
	Current	Constant	Current	Constant	Current	Constant	Current	Constant
	billion $							
1972	15.9	43.1	0.4	1.0	0.8	2.3	17.0	46.3
1973	18.0	46.3	0.5	1.2	0.9	2.3	19.4	49.8
1974	22.0	48.7	0.6	1.3	1.0	2.3	23.6	52.3
1975	26.7	53.7	0.7	1.3	1.1	2.3	28.4	57.3
1976	29.9	56.6	0.7	1.4	1.3	2.5	31.9	60.5
1977	32.8	57.8	0.8	1.5	1.5	2.7	35.1	62.0
1978	36.9	60.3	0.9	1.8	1.6	2.8	39.5	64.9
1979	42.8	62.4	1.1	1.6	1.8	2.7	45.6	66.8
1980	48.4	63.0	1.3	1.9	1.8	2.4	51.5	67.3
1981	53.4	62.6	1.4	1.8	1.7	2.2	56.5	66.5
1982	53.4	59.5	1.4	1.7	1.8	2.1	56.6	63.2
1983	56.3	60.9	1.4	1.6	2.3	2.6	60.0	65.1
1984	62.8	66.0	1.4	1.5	2.3	2.5	66.4	70.0
1985	67.3	67.3	1.3	1.4	2.4	2.5	70.9	72.7
1986	70.1	70.1	1.5	1.6	2.6	2.6	74.2	76.4
1987	72.5	72.5	1.5	1.5	2.6	2.6	76.7	76.7
1988	76.6	76.6	1.7	1.6	2.8	2.7	81.1	79.1
1989	80.6	80.6	1.8	1.7	3.0	2.7	85.4	80.1
1990	85.1	85.1	1.8	1.6	3.1	2.7	90.0	81.8

Source: G.L. Rutledge & M.L. Leonard, Pollution abatement and control expenditures, 1972-90, Survey of Current Business, table 9, pp. 35-38, (Washington, DC: DOC, BEA, June 1992).

Notes: Constant=1987 $. Expenditures are for goods and services that U.S. residents use to produce cleaner air and water and to manage solid waste. Pollution abatement directly reduces emissions by preventing the generation of pollutants, by recycling the pollutants, or by treating the pollutants prior to discharge. Regulation and monitoring are government activities that stimulate and guide action to reduce pollutant emissions. Research and development by business and government not only support abatement but also help increase the efficiency of regulation and monitoring. Data for 1972-1989 are revised estimates. Data for 1990 are new estimates. Estimates do not include interest costs. Totals may not agree with detail because of independent rounding.

Related Tables: 7, 9-13, 93.

Table 9.—Pollution abatement expenditures, by type of pollution, 1981-1990.

Year	Air		Water		Solid waste	
	Current	Constant	Current	Constant	Current	Constant
	billion $					
1981	26.3	28.5	20.8	25.2	10.2	13.4
1982	26.1	27.2	21.1	24.2	9.9	12.1
1983	27.6	28.5	22.5	24.7	10.3	12.0
1984	30.4	31.0	24.7	26.2	11.8	13.2
1985	30.1	32.0	26.7	27.4	12.7	13.7
1986	32.1	33.3	28.2	28.7	14.3	14.8
1987	30.7	30.7	30.6	30.6	15.9	15.9
1988	32.5	31.9	30.7	30.1	18.6	17.9
1989	30.9	29.2	33.4	31.6	21.7	19.8
1990	29.5	27.3	37.3	34.4	24.1	20.9

Source: G.L. Rutledge & M.L. Leonard, Pollution abatement and control expenditures, 1972-90, Survey of Current Business, table 9, pp. 35-38, (Washington, DC: DOC, BEA, June 1992).

Notes: Constant=1987 $. Expenditures cover most, but not all, pollution abatement and control activities, which are defined as those resulting from rules, policies and conventions, and formal regulations restricting the release of pollutants into common-property media such as the air and water. Solid waste management includes the collection and disposal of solid waste and the alteration of production processes that generate less solid waste. Data for 1981-89 are revised estimates. Data for 1990 are new estimates. Estimates do not include interest costs.

Related Tables: 7-13, 93.

Table 10.—Pollution abatement and control expenditures, by sector, 1972-1990.

Year	Pollution abatement					Regulation & monitoring		Research & development		
	Private		Government							
	Pers'l	Bus.	Fed.	State	Other	Fed.	State	Prv't	Fed.	State
	billion 1987 $									
1972	3.45	30.53	0.40	3.67	5.03	0.48	0.48	1.44	0.55	0.27
1973	4.54	32.14	0.54	3.69	5.34	0.63	0.56	1.49	0.68	0.17
1974	4.95	32.63	0.69	3.62	6.81	0.74	0.6	1.42	0.78	0.09
1975	6.17	33.11	0.94	3.74	9.72	0.74	0.61	1.28	0.93	0.10
1976	6.73	34.88	0.95	3.71	10.33	0.74	0.67	1.39	1.02	0.09
1977	7.15	37.1	0.92	3.73	8.90	0.74	0.78	1.56	1.04	0.10
1978	7.41	38.15	0.81	3.89	10.03	0.99	0.8	1.69	0.99	0.10
1979	7.16	40.22	0.84	3.93	10.27	0.91	0.72	1.76	0.87	0.12
1980	7.31	40.15	0.68	4.05	10.82	1.11	0.76	1.50	0.82	0.10
1981	8.49	40.47	0.63	3.98	8.98	1.04	0.77	1.33	0.81	0.04
1982	8.52	37.79	0.65	4.07	8.43	0.98	0.73	1.32	0.70	0.04
1983	10.02	38.04	0.91	4.20	7.70	0.92	0.69	1.82	0.71	0.04
1984	10.97	41.18	1.05	4.38	8.42	0.81	0.69	1.81	0.63	0.04
1985	11.78	42.41	1.30	4.65	8.67	0.61	0.75	1.86	0.62	0.02
1986	12.69	43.80	1.40	4.99	9.29	0.74	0.85	1.93	0.67	0.03
1987	10.88	44.50	1.24	5.36	10.54	0.70	0.82	1.99	0.63	0.03
1988	11.83	45.96	1.34	5.88	9.78	0.81	0.83	1.99	0.64	0.03
1989	10.15	47.76	1.27	6.50	10.04	0.78	0.88	1.99	0.72	0.03
1990	8.67	49.69	1.23	6.99	10.89	0.77	0.87	2.01	0.68	0.04

Source: G.L. Rutledge & M.L. Leonard, Pollution abatement and control expenditures, 1972-90, Survey of Current Business, table 9, pp. 35-38, (Washington, DC: DOC, BEA, June 1992).

Notes: Expenditures are attributed to the sector that performs the air or water pollution abatement or solid waste collection and disposal. State also includes expenditures by local authorities but excludes agricultural production except feedlot operations. Pers'l=Personal consumption (all of which is used to purchase and operate motor vehicle emission abatement devices). Bus.=Business. Fed.=Federal government. Prv't=Private (=business spending). Other government spending refers to government enterprise fixed capital for publicly owned electric utilities and public sewer systems. Data do not include interest costs. Totals may not agree with detail on preceding tables because of independent rounding.

Related Tables: 7-9, 11-13, 42, 93-97.

Table 11.—Pollution abatement expenditures, by selected industries, 1973-1991.

	Chemicals and allied products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	164.4	214.6	16.8	395.9	174.1	247.6	80.2	502.3	83.1
1974	250.6	264.4	24.1	539.2	203.8	335.6	104.0	643.3	104.5
1975	359.5	387.7	35.0	780.2	249.9	430.9	126.7	807.4	140.7
1976	319.8	577.4	44.7	942.0	295.6	514.7	173.2	983.5	188.7
1977	339.9	593.1	49.6	982.5	335.5	685.2	217.6	1,238.3	206.4
1978	376.3	385.9	65.1	827.5	398.8	794.1	280.1	1,473.0	231.3
1979	314.6	360.7	95.6	770.9	485.3	895.2	287.0	1,667.5	230.4
1980	325.9	350.0	104.8	780.7	539.9	942.9	368.8	1,851.8	305.9
1981	335.0	322.2	95.6	752.8	571.7	1,069.1	406.9	2,047.8	341.1
1982	272.8	256.5	98.3	627.6	556.1	1,112.3	438.2	2,106.5	345.2
1983	159.0	187.4	49.0	395.4	624.9	1,106.0	467.4	2,198.2	297.4
1984	142.9	212.4	32.7	418.1	622.0	1,206.3	517.1	2,345.4	357.5
1985	193.7	271.5	272.5	738.1	672.9	1,267.7	599.4	2,540.0	268.6
1986	197.8	325.5	101.0	624.4	646.5	1,301.8	705.9	2,654.3	336.4
1988	370.7	487.8	236.5	1,095.0	706.4	1,428.5	940.1	3,074.9	443.8
1989	380.3	598.6	215.9	1,194.8	794.0	1,613.8	1,101.4	3,509.2	395.9
1990	596.0	994.0	261.0	1,851.0	858.0	1,797.0	1,293.0	3,948.0	405.7
1991	818.0	942.0	308.0	2,068.0	880.0	1,787.0	1,381.0	4,047.0	na

	Petroleum and coal products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	222.5	96.1	3.2	321.8	192.5	125.4	19.9	337.8	44.3
1974	341.3	119.7	1.3	462.3	238.3	153.3	28.5	420.1	83.5
1975	398.2	155.7	1.7	555.7	339.4	192.1	31.7	563.1	137.7
1976	236.5	199.8	5.2	441.4	466.1	263.3	45.3	774.8	183.8
1977	167.7	195.6	5.3	368.5	601.3	289.3	57.4	948.0	238.4
1978	311.2	100.5	7.6	419.3	636.4	304.1	57.0	997.4	261.8
1979	397.8	119.4	17.1	534.3	750.7	370.8	25.3	1,173.8	324.1
1980	402.3	114.2	15.4	531.9	910.1	406.9	101.0	1,418.0	506.7
1981	440.8	131.7	18.2	590.6	1,118.0	437.2	130.2	1,685.5	565.6
1982	533.2	165.7	13.1	712.1	1,195.1	472.0	133.7	1,800.8	335.3
1983	308.2	164.7	12.0	485.0	1,203.6	552.3	137.9	1,893.7	524.9
1984	195.1	96.8	19.8	311.7	1,327.9	583.8	171.1	2,083.5	552.8
1985	175.0	88.4	27.0	290.4	1,278.5	586.5	198.5	2,063.4	500.0
1986	273.6	121.5	29.2	424.3	1,230.9	578.0	196.4	2,005.2	498.2
1988	208.2	203.7	70.8	482.8	1,175.8	547.1	252.1	2,005.5	480.0
1989	146.5	230.4	40.7	417.6	1,258.2	578.7	333.0	2,170.0	523.1
1990	426.0	401.0	90.0	917.0	1,472.0	702.0	531.0	2,705.0	562.0
1991	997.0	373.0	93.0	1,463.0	1,465.0	794.0	590.0	2,849.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by selected industries, 1973-1991.

Rubber and miscellaneous plastic products

Year	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
1973	13.5	7.3	3.3	24.2	12.2	10.1	20.4	42.6	4.6
1974	22.2	13.5	2.2	37.9	15.7	15.1	28.2	58.8	19.5
1975	22.2	6.6	3.1	31.9	20.7	18.4	25.7	64.8	12.5
1976	24.2	10.0	3.1	37.4	22.3	24.0	34.0	80.3	15.8
1977	17.4	13.8	5.4	36.6	19.8	18.9	35.1	73.8	7.7
1978	18.7	5.5	3.4	27.7	17.7	23.9	43.3	84.9	8.0
1979	12.9	9.3	2.9	25.1	32.2	29.6	49.9	111.7	13.6
1980	12.6	6.9	2.3	21.7	30.4	27.6	50.2	108.2	18.1
1981	15.3	5.9	6.5	21.8	29.8	29.4	58.8	118.3	14.0
1982	14.8	7.7	2.7	25.2	22.2	28.2	39.8	90.2	7.0
1983	12.0	3.8	7.8	23.6	50.9	52.8	62.0	165.8	6.6
1984	20.5	7.0	5.8	33.4	51.1	48.7	68.1	168.0	9.9
1985	21.3	3.2	5.2	29.7	46.7	55.6	90.8	193.1	10.0
1986	20.1	9.7	6.2	36.0	50.9	52.0	123.3	226.2	15.1
1988	21.7	11.3	7.8	40.7	62.5	62.2	153.3	227.9	18.7
1989	50.3	16.0	12.0	78.2	85.3	99.6	218.4	403.3	25.6
1990	69.0	11.0	14.0	94.0	97.0	113.0	218.0	428.0	24.3
1991	51.0	19.0	12.0	82.0	121.0	77.0	243.0	441.0	na

Stone, clay, and glass products

Year	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
1973	131.6	14.4	4.7	150.7	73.7	16.4	27.0	117.0	24.5
1974	185.8	13.1	10.0	208.8	98.7	24.7	29.4	152.9	33.1
1975	152.7	16.7	4.1	173.5	109.7	28.3	33.8	171.8	41.7
1976	82.2	18.9	3.6	104.7	122.8	30.3	39.0	192.1	59.3
1977	85.8	39.1	8.6	133.4	141.7	28.0	44.5	214.5	68.7
1978	98.1	28.0	3.7	123.8	163.7	33.2	54.2	251.1	74.8
1979	110.2	25.4	10.0	145.6	188.0	45.1	60.5	293.6	82.4
1980	123.1	17.9	10.0	151.0	182.1	48.2	71.4	301.7	83.9
1981	165.5	13.8	9.2	188.5	191.0	47.3	72.5	310.7	91.5
1982	84.9	14.0	6.3	105.2	142.8	44.0	39.8	260.2	56.0
1983	57.9	9.8	28.2	95.9	179.9	55.8	84.6	320.4	45.2
1984	65.6	13.1	5.2	84.0	215.0	64.2	98.7	377.9	46.2
1985	44.4	9.9	7.5	61.9	217.2	66.7	109.3	393.2	31.5
1986	53.1	13.7	17.6	84.4	237.0	68.2	118.3	423.6	46.7
1988	42.6	13.6	6.1	62.3	247.7	67.7	123.1	438.4	103.3
1989	73.2	17.1	7.0	97.3	328.4	85.0	178.3	591.7	52.3
1990	94.0	20.0	14.0	128.0	248.0	93.0	157.0	498.0	49.3
1991	120.0	22.0	12.0	154.0	221.0	85.0	169.0	221.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by selected industries, 1973-1991.

	Primary metal industries								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	397.2	84.7	16.8	498.6	264.7	148.3	53.8	466.8	51.5
1974	510.5	132.7	12.5	646.8	339.6	181.2	69.5	590.2	76.9
1975	640.6	187.5	5.4	833.5	429.9	209.4	75.9	715.2	95.3
1976	632.5	197.8	3.4	833.7	575.7	229.5	90.7	895.8	100.7
1977	616.0	250.2	8.4	874.6	721.6	268.3	132.3	1,122.3	126.3
1978	563.3	219.1	9.4	791.8	809.6	333.0	178.9	1,321.4	141.7
1979	588.8	227.3	6.9	823.1	981.7	442.0	163.5	1,587.2	241.8
1980	539.7	180.7	19.6	740.0	998.2	463.2	215.3	1,677.3	169.5
1981	567.2	144.1	16.9	728.2	1,111.9	549.2	250.7	1,911.8	189.7
1982	423.1	133.7	13.0	569.8	897.2	448.4	167.6	1,513.6	148.5
1983	147.6	100.2	7.5	225.3	904.3	454.6	256.7	1,615.6	95.4
1984	175.2	72.9	26.0	274.0	1,017.3	450.7	301.7	1,769.7	171.6
1985	142.9	84.3	25.6	252.9	1,067.0	517.4	278.7	1,863.0	136.8
1986	102.8	74.6	48.4	225.9	968.5	509.4	264.1	1,721.9	184.6
1988	167.3	100.6	41.8	309.8	965.8	516.1	327.2	1,809.0	189.8
1989	216.3	138.7	52.1	407.0	883.1	574.3	473.7	1,931.1	190.4
1990	279.0	167.0	54.0	499.0	944.0	565.0	545.0	2,054.0	206.3
1991	499.0	132.0	42.0	673.0	912.0	564.0	527.0	2,002.0	na

	Fabricated metal products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	39.6	21.5	2.7	63.7	27.0	35.7	22.2	84.8	9.1
1974	56.4	28.2	5.9	90.5	34.5	44.9	30.7	110.1	8.2
1975	46.9	29.0	1.7	77.5	32.6	45.7	31.3	109.5	7.5
1976	35.5	34.1	3.4	72.9	35.4	52.7	36.1	124.3	6.3
1977	32.5	39.2	5.0	76.7	40.3	66.1	42.8	149.2	3.5
1978	33.1	26.2	2.3	61.6	42.1	73.8	52.8	168.7	4.5
1979	36.7	24.5	4.9	66.1	57.0	99.7	64.2	220.9	13.4
1980	37.5	34.8	4.2	76.4	49.0	88.2	81.9	219.2	23.9
1981	37.5	30.4	7.6	75.7	51.6	93.4	85.0	230.5	21.5
1982	57.9	43.3	6.7	95.9	48.6	103.4	71.5	223.5	13.0
1983	27.0	32.9	10.6	70.6	81.9	137.8	146.6	366.3	17.7
1984	25.2	82.5	17.6	125.3	64.9	128.2	155.4	348.5	37.0
1985	40.4	59.7	16.8	116.9	79.4	163.2	165.5	408.1	15.4
1986	36.7	80.9	18.2	135.8	95.6	187.7	219.2	502.5	27.1
1988	45.5	75.3	26.1	146.8	135.0	316.8	310.1	761.9	29.1
1989	50.5	71.3	29.2	151.0	123.3	389.4	382.4	895.7	21.9
1990	53.0	61.0	57.0	171.0	114.0	344.0	356.0	814.0	20.0
1991	81.0	66.0	30.0	177.0	124.0	301.0	408.0	843.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by selected industries, 1973-1991.

Year	Machinery, except electrical								
	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
1973	36.6	15.6	4.1	56.3	19.7	23.0	29.9	72.5	14.3
1974	41.9	17.6	8.1	67.7	24.3	29.1	38.2	91.7	11.0
1975	37.5	20.8	2.3	60.5	28.4	33.7	36.0	98.0	11.9
1976	44.8	21.8	2.9	69.4	30.8	37.7	49.6	117.9	15.9
1977	42.3	42.4	5.5	90.2	33.1	49.8	52.6	135.4	17.6
1978	41.2	27.8	12.6	81.5	41.0	54.4	63.1	158.8	14.8
1979	38.5	38.2	7.8	84.5	50.1	69.0	81.1	200.2	19.9
1980	34.0	34.9	5.6	74.5	48.0	73.0	85.3	206.4	17.6
1981	30.9	28.0	8.2	67.1	47.3	81.6	91.7	220.9	18.1
1982	29.2	42.2	6.8	78.2	46.6	85.3	75.7	207.6	11.4
1983	17.7	19.0	14.3	51.0	58.0	105.0	127.5	290.5	18.8
1984	13.8	22.6	6.7	43.1	68.4	115.7	130.3	314.4	15.8
1985	21.2	35.1	12.7	69.0	76.0	119.9	147.7	344.0	12.1
1986	16.7	25.7	6.3	48.7	81.4	128.3	149.1	358.8	12.6
1988	21.8	33.2	22.3	77.2	68.4	139.4	221.8	429.6	14.7
1989	99.8	54.8	14.9	169.5	80.6	170.5	320.8	571.9	13.9
1990	46.0	41.0	20.0	107.0	78.0	159.0	320.0	577.0	19.5
1991	89.0	28.0	12.0	128.0	70.0	165.0	339.0	574.0	na

Year	Electric, electronic equipment								
	Capital expenditures				Operating costs				Costs recovered
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	
	million $								
1973	27.0	22.2	3.5	52.7	20.2	38.9	28.1	87.2	18.5
1974	24.6	28.0	3.1	55.6	22.7	39.8	26.2	88.6	20.3
1975	22.7	26.2	3.3	52.3	27.6	43.1	26.7	97.3	14.3
1976	23.0	31.3	4.1	58.4	26.8	50.8	32.3	109.9	23.7
1977	23.0	36.0	4.9	63.8	28.0	63.2	37.1	128.1	16.0
1978	32.9	36.0	3.3	72.2	30.7	71.7	46.1	148.6	12.9
1979	41.8	42.0	7.1	90.9	46.7	82.8	52.8	182.3	24.1
1980	43.5	27.1	8.4	79.0	45.2	87.8	71.9	205.0	17.0
1981	48.7	41.0	7.4	97.1	51.8	106.2	88.8	247.1	22.0
1982	58.1	40.9	6.9	105.9	55.1	116.6	88.7	260.2	14.2
1983	43.8	45.1	8.0	97.0	77.3	142.0	134.5	353.8	15.1
1984	38.3	59.5	14.6	112.4	74.6	150.3	139.1	364.0	18.3
1985	45.4	74.1	18.3	137.7	78.0	174.0	176.3	428.2	15.2
1986	46.6	61.5	17.0	125.1	88.3	210.9	231.5	530.8	19.4
1988	80.6	54.6	19.0	154.2	92.2	252.5	314.6	659.3	39.1
1989	66.6	94.3	27.8	188.7	100.9	308.9	319.3	729.1	29.3
1990	93.0	58.0	26.0	178.0	113.0	370.0	304.0	788.0	42.9
1991	91.0	123.0	20.0	234.0	100.0	324.0	410.0	833.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by selected industries, 1973-1991.

Year	Transportation equipment								
	Capital expenditures				Operating costs				Costs
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	52.6	41.7	6.9	101.2	35.2	51.1	43.4	129.8	20.1
1974	52.7	41.5	9.2	103.4	44.8	59.5	50.5	154.8	13.6
1975	32.1	36.4	6.8	75.4	52.2	66.4	49.7	168.3	13.4
1976	21.1	53.6	3.8	78.5	56.9	83.5	57.6	197.9	14.5
1977	36.9	39.4	6.3	82.6	60.6	97.3	76.1	233.9	13.5
1978	71.0	57.9	10.7	139.5	77.3	110.2	93.0	280.5	16.6
1979	120.1	59.5	99.9	189.5	96.4	126.3	109.1	331.8	36.9
1980	201.4	60.7	12.9	275.0	110.7	137.4	153.2	401.5	24.6
1981	209.2	60.0	14.2	283.3	117.5	150.7	157.7	426.1	19.3
1982	59.7	36.5	12.1	108.3	105.6	153.5	137.6	396.5	18.2
1983	33.0	55.0	10.2	98.3	157.5	224.2	178.6	560.3	22.3
1984	71.3	116.9	19.4	207.6	192.9	280.1	212.6	685.6	22.7
1985	254.5	165.1	36.9	456.5	194.5	283.9	260.3	738.8	23.7
1986	432.4	81.8	26.8	541.1	195.7	338.5	304.9	839.0	28.2
1988	87.6	80.4	42.2	210.2	215.7	299.2	459.5	974.4	38.7
1989	156.0	84.6	46.2	286.8	212.2	318.1	470.1	1,000.3	43.1
1990	207.0	143.0	46.0	395.0	247.0	373.0	612.0	1,232.0	41.2
1991	176.0	95.0	31.0	301.0	225.0	320.0	544.0	1,118.0	na

Year	Instruments and related products								
	Capital expenditures				Operating costs				Costs
	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	3.0	5.6	3.2	11.8	2.0	11.3	8.6	21.9	2.2
1974	3.6	6.7	5.5	15.7	4.9	15.0	14.3	34.1	3.5
1975	11.2	17.3	1.1	29.6	5.9	19.5	13.2	38.5	4.3
1976	10.9	12.2	9.3	32.3	8.7	22.3	14.8	45.7	11.6
1977	14.5	8.5	1.4	24.4	9.0	23.0	15.4	47.3	6.1
1978	6.8	9.5	0.6	16.9	7.3	26.9	21.6	55.8	5.0
1979	13.0	7.7	2.5	23.2	10.6	30.7	27.9	69.2	15.2
1980	11.3	12.7	3.2	27.2	11.3	33.7	32.1	77.1	11.8
1981	14.4	23.7	2.1	40.1	12.8	40.0	37.9	90.4	9.4
1982	18.7	9.8	1.4	30.0	12.9	33.9	33.3	80.2	10.3
1983	10.4	9.5	1.2	21.1	25.0	53.9	85.0	163.8	11.2
1984	10.9	11.1	1.7	23.7	23.6	67.3	70.8	161.9	w/h
1985	13.8	7.8	3.1	24.8	24.2	71.8	69.1	165.1	10.9
1986	10.8	5.1	2.9	18.8	19.9	78.6	66.0	164.4	12.0
1988	15.5	11.8	3.4	30.7	21.7	79.9	96.1	197.7	19.5
1989	33.9	37.8	14.4	86.1	36.2	70.9	132.8	239.9	19.8
1990	58.0	26.0	8.0	92.0	37.0	69.0	142.0	248.0	18.8
1991	27.0	44.0	33.0	104.0	33.0	78.0	169.0	280.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by selected industries, 1973-1991.

Food and kindred products									
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	77.6	104.8	14.3	196.7	39.1	110.4	53.6	203.1	32.6
1974	73.4	111.7	14.3	199.2	48.8	143.5	76.8	268.9	52.2
1975	75.6	93.9	11.4	180.9	53.2	153.7	87.7	294.2	62.6
1976	102.5	97.6	7.4	207.5	57.7	187.5	100.5	345.9	63.7
1977	67.9	103.6	12.5	183.9	56.2	211.6	89.5	357.1	53.3
1978	67.7	94.4	12.9	175.0	69.4	243.2	99.4	412.0	57.1
1979	57.9	111.1	13.6	182.7	91.0	297.9	115.3	504.2	80.3
1980	61.7	133.0	13.5	208.2	81.6	314.3	123.6	519.4	79.5
1981	53.9	104.8	14.8	173.5	78.3	343.3	157.5	579.1	91.2
1982	47.4	110.9	11.0	169.3	77.1	328.1	116.2	522.1	51.1
1983	37.7	105.1	10.9	153.8	96.1	402.3	151.3	649.6	32.7
1984	50.6	91.8	12.2	154.5	101.3	458.1	155.0	714.4	43.7
1985	66.2	77.4	11.7	155.1	106.3	525.2	201.0	832.1	33.4
1986	61.9	108.2	15.7	185.8	126.0	559.9	246.1	932.1	w/h
1988	100.2	91.0	19.8	211.0	157.8	673.3	328.9	1,160.0	110.6
1989	51.7	183.6	25.2	260.6	137.4	663.5	255.3	1,056.2	82.0
1990	65.0	163.0	21.0	249.0	146.0	693.0	271.0	1,109.0	87.0
1991	95.0	360.0	28.0	482.0	150.0	789.0	316.0	1,264.0	na

Textile mill products									
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	10.3	17.7	1.2	29.2	6.3	23.5	9.0	38.8	2.8
1974	12.7	17.7	1.7	32.0	9.4	31.3	13.3	54.0	2.5
1975	19.7	22.2	1.1	43.0	9.4	29.4	12.0	50.7	w/h
1976	9.2	42.6	1.6	53.3	9.2	41.8	14.3	65.3	8.4
1977	20.7	14.7	1.4	36.7	10.9	46.4	31.0	75.0	6.6
1978	42.7	15.4	1.6	59.7	19.0	51.6	21.9	92.5	w/h
1979	21.9	15.2	2.1	39.2	19.0	60.2	22.5	101.7	10.5
1980	32.5	23.6	3.5	59.5	16.6	59.3	39.9	115.8	13.4
1981	27.2	16.2	4.6	48.0	18.9	60.2	29.4	108.5	18.2
1982	12.2	6.2	3.6	22.0	14.8	41.4	18.3	74.7	7.6
1983	9.4	8.4	0.9	18.7	21.3	54.5	25.4	101.1	5.4
1984	12.8	6.3	1.8	20.9	25.8	68.4	28.0	122.2	5.3
1985	12.2	10.3	2.1	24.7	30.9	82.6	35.4	148.9	3.3
1986	12.3	10.5	2.6	25.5	28.5	94.9	38.2	161.6	w/h
1988	8.0	8.0	2.9	18.9	30.5	98.3	47.6	177.0	10.7
1989	9.7	16.5	3.3	29.5	25.3	109.4	51.3	185.9	5.8
1990	19.0	25.0	2.0	46.0	26.0	115.0	58.0	198.0	6.3
1991	29.0	21.0	8.0	57.0	36.0	124.0	54.0	214.0	na

continued

Table 11 (continued).—Pollution abatement expenditures, by selected industries, 1973-1991.

	Lumber and wood products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	41.5	11.7	9.6	62.7	14.9	18.5	28.2	61.6	7.6
1974	58.4	7.6	15.0	81.1	19.5	14.0	30.8	64.2	12.8
1975	46.4	7.7	21.0	75.1	22.7	19.6	28.3	70.5	17.4
1976	29.5	9.2	12.5	51.1	26.6	21.1	33.6	81.3	25.5
1977	33.9	19.1	6.9	59.9	20.4	19.2	33.9	73.4	15.3
1978	46.9	25.6	12.0	84.5	27.7	19.4	43.7	90.7	26.7
1979	67.5	12.3	13.8	93.6	40.2	25.5	49.7	115.4	28.4
1980	55.8	15.6	10.1	81.5	39.6	32.9	56.4	129.1	37.6
1981	49.2	10.5	18.8	78.5	43.2	26.9	64.6	134.7	29.7
1982	20.0	11.7	1.5	33.2	26.4	23.4	37.3	87.1	16.6
1983	18.0	4.0	3.2	25.2	31.1	27.8	43.9	102.8	9.0
1984	24.1	18.8	5.7	48.5	41.2	30.7	42.4	114.2	13.6
1985	15.2	6.3	13.0	34.5	41.8	35.3	62.0	139.1	10.4
1986	17.8	11.0	4.6	33.3	61.7	42.6	74.7	178.9	14.7
1988	31.6	7.5	5.4	44.5	84.0	57.6	94.5	236.1	24.0
1989	45.9	6.6	7.5	60.0	88.4	38.6	143.0	270.0	19.5
1990	58.0	10.0	37.0	105.0	86.0	37.0	136.0	259.0	31.6
1991	102.0	14.0	25.0	141.0	91.0	35.0	173.0	298.0	na

	Paper and allied products								
	Capital expenditures				Operating costs				Costs
Year	Air	Water	Solid waste	Total	Air	Water	Solid waste	Total	re-covered
	million $								
1973	166.4	161.0	12.1	339.6	59.2	118.1	43.2	220.5	54.6
1974	270.8	193.2	12.9	476.9	81.2	152.0	55.7	289.0	84.8
1975	323.0	266.0	16.3	605.3	100.9	185.5	57.5	344.0	112.2
1976	180.6	278.6	27.3	486.6	123.3	239.1	67.3	430.3	137.6
1977	134.1	261.7	31.6	427.4	133.5	309.0	86.4	529.0	150.8
1978	123.9	189.0	28.7	341.6	158.4	357.6	105.6	622.0	175.6
1979	207.0	180.6	38.8	426.4	176.6	400.5	121.1	698.2	161.5
1980	197.4	111.2	31.0	339.6	196.2	436.7	129.1	762.1	248.1
1981	168.0	86.5	31.1	285.5	211.8	469.9	148.0	829.7	298.5
1982	190.0	93.7	29.7	313.4	206.7	455.2	134.1	796.0	213.7
1983	122.3	65.9	27.9	216.1	226.5	508.9	183.6	919.1	255.3
1984	151.9	68.2	42.1	262.3	280.7	566.1	213.2	1,060.1	118.4
1985	190.9	106.0	35.6	332.4	313.0	573.4	234.4	1,120.8	107.3
1986	137.1	96.9	37.3	271.3	319.2	565.7	269.7	1,154.6	133.8
1988	233.4	97.2	87.1	417.7	372.4	627.7	343.2	1,343.3	245.6
1989	392.4	261.0	54.9	808.2	388.1	686.8	374.2	1,449.0	264.9
1990	414.0	510.0	152.0	1,075.0	398.0	788.0	421.0	1,607.0	266.4
1991	481.0	553.0	199.0	1,233.0	401.0	791.0	444.0	1,835.0	na

Source: U.S. Department of Commerce, Bureau of the Census, Pollution Abatement Costs and Expenditures, Current Industrial Reports, MA-200. (Washington, DC: DOC, annual).

Notes: Data for 1987 not available. w/h=withheld by industry.

Table 12.—U.S. government outlays, by function and superfunction, 1962-1992.

Year	Superfunction						
	National defense	Human resources	Physical resources	Net interest	Others	Undistributed	Total
	billion current $						*trillion current $*
1962	52	32	9	7	12	- 5	0.11
1963	53	34	8	8	14	- 6	0.11
1964	55	35	10	8	16	- 6	0.12
1965	51	37	11	9	17	- 6	0.12
1966	58	42	13	9	17	- 7	0.13
1967	71	51	15	10	17	- 7	0.16
1968	82	59	16	11	18	- 8	0.18
1969	82	66	12	13	18	- 8	0.18
1970	82	75	16	14	17	- 9	0.20
1971	79	92	18	15	16	-10	0.21
1972	79	107	20	15	19	-10	0.23
1973	77	120	21	17	25	-13	0.25
1974	79	136	25	21	24	-17	0.27
1975	87	173	35	23	27	-14	0.33
1976	90	204	39	27	27	-14	0.37
1977	97	222	41	30	34	-15	0.41
1978	104	242	53	35	40	-16	0.46
1979	116	268	54	43	40	-17	0.50
1980	134	313	66	53	45	-20	0.59
1981	158	362	71	69	47	-28	0.68
1982	185	389	62	85	51	-26	0.75
1983	210	426	58	90	59	-34	0.81
1984	227	432	58	111	55	-32	0.85
1985	253	472	57	129	68	-33	0.95
1986	273	482	59	136	74	-33	0.99
1987	282	502	55	139	63	-36	1.00
1988	290	533	68	152	57	-37	1.06
1989	304	569	82	169	58	-37	1.14
1990	299	619	125	184	61	-37	1.25
1991	273	690	134	195	71	-39	1.32
1992	307	777	153	199	78	-39	1.48

continued

Table 12 (continued).—U.S. government outlays, by function and superfunction, 1962-1992.

	Physical resources function					
Year	Energy	Natural resources & environment	Commerce & housing credit	Trans-portation	Community & regional development	Total physical resources
	billion current $					
1962	0.6	2.0	1.4	4.3	0.5	8.8
1963	0.5	2.3	0.1	4.6	0.6	8.0
1964	0.6	2.4	0.4	5.2	0.9	9.5
1965	0.7	2.5	1.2	5.8	1.1	11.3
1966	0.6	2.7	3.2	5.7	1.1	13.4
1967	0.8	2.9	4.0	5.9	1.1	14.7
1968	1.0	3.0	4.3	6.3	1.4	16.0
1969	1.0	2.9	- 0.1	6.5	1.6	11.9
1970	1.0	3.1	2.1	7.0	2.4	15.6
1971	1.0	3.9	2.4	8.1	2.9	18.3
1972	1.3	4.2	2.2	8.4	3.4	19.6
1973	1.2	4.8	0.9	9.1	4.6	20.6
1974	1.3	5.7	4.7	9.2	4.2	25.1
1975	2.9	7.3	9.9	10.9	4.3	35.4
1976	4.2	8.2	7.6	13.7	5.4	39.2
1977	5.8	10.0	3.1	14.8	7.0	40.7
1978	8.0	11.0	6.3	15.5	11.8	52.6
1979	9.2	12.1	4.7	17.5	10.5	54.0
1980	10.2	13.9	9.4	21.3	11.3	66.0
1981	15.2	13.6	8.2	23.4	10.6	70.9
1982	13.5	13.0	6.3	20.6	8.3	61.8
1983	9.4	12.7	6.7	21.3	7.6	57.6
1984	7.1	12.6	6.9	23.7	7.7	57.9
1985	5.7	13.4	4.2	25.8	7.7	56.8
1986	4.7	13.6	4.9	28.1	7.2	58.6
1987	4.1	13.4	6.2	26.2	5.1	54.9
1988	2.3	14.6	18.8	27.3	5.3	68.3
1989	3.7	16.2	29.2	27.6	5.4	82.1
1990	2.4	17.1	67.1	29.5	8.5	124.6
1991	1.7	18.6	75.6	31.1	6.8	133.8
1992	4.0	20.2	87.2	34.0	7.5	153.0

continued

Table 12 (continued).—U.S. government outlays, by function and superfunction, 1962-1992.

	Natural resources & environment											
	Water resources		Conservation & land management		Recrea-tional resources		Pollution control & abatement		Other natural resources		Total	
Year	$	'87$	$	'87$	$	'87 $	$	'87 $	$	'87$	$	'87 $
	billion											
1962	1.3	4.8	0.3	1.3	0.2	0.6	0.1	0.3	0.2	0.7	2.0	7.6
1963	1.4	5.3	0.3	1.2	0.2	0.7	0.1	0.3	0.2	0.8	2.3	8.3
1964	1.5	5.3	0.3	1.2	0.2	0.7	0.1	0.4	0.3	0.9	2.4	8.6
1965	1.5	5.5	0.3	1.2	0.2	0.8	0.1	0.5	0.3	1.0	2.5	9.0
1966	1.7	5.9	0.3	1.1	0.2	0.8	0.2	0.5	0.3	1.1	2.7	9.4
1967	1.7	5.6	0.4	1.2	0.3	0.9	0.2	0.6	0.4	1.2	2.9	9.5
1968	1.6	5.3	0.4	1.3	0.3	1.0	0.2	0.8	0.4	1.2	3.0	9.6
1969	1.6	4.9	0.3	0.8	0.4	1.1	0.3	0.9	0.4	1.1	2.9	8.8
1970	1.5	4.4	0.4	1.1	0.4	1.1	0.4	1.1	0.4	0.2	3.1	8.9
1971	1.8	4.9	0.5	1.3	0.5	1.3	0.7	1.9	0.5	1.4	3.9	10.8
1972	1.9	5.1	0.4	1.2	0.5	0.4	0.8	2.0	0.6	0.5	4.2	11.1
1973	2.2	5.5	0.3	0.8	0.5	0.4	1.1	2.8	0.6	0.4	4.8	11.9
1974	2.2	5.1	0.1	0.3	0.6	0.5	2.0	4.7	0.7	0.5	5.7	13.2
1975	2.6	5.5	0.7	1.4	0.8	0.7	2.5	5.3	0.8	0.6	7.3	15.4
1976	2.7	5.4	0.6	1.2	0.9	0.7	3.1	6.0	0.9	0.7	8.2	16.0
1977	3.2	5.8	0.6	1.1	1.0	0.8	4.3	7.7	1.0	0.7	10.0	18.1
1978	3.4	5.8	1.0	1.7	1.4	2.4	4.0	6.7	1.2	1.9	11.0	18.4
1979	3.9	6.0	0.8	1.3	1.5	2.3	4.7	7.3	1.3	2.0	12.1	18.7
1980	4.2	6.0	1.0	1.5	1.7	2.4	5.5	7.8	1.4	2.0	13.9	19.6
1981	4.1	5.3	1.2	1.5	1.6	2.1	5.2	6.7	1.5	1.9	13.6	17.5
1982	3.9	4.7	1.1	1.3	1.4	1.7	5.0	6.0	1.5	0.8	13.0	15.6
1983	3.9	4.5	1.5	1.7	1.5	1.7	4.3	4.9	1.5	0.8	12.7	14.6
1984	4.1	4.5	1.3	1.4	1.6	1.7	4.0	4.5	1.6	1.8	12.6	13.9
1985	4.1	4.4	1.5	1.6	1.6	1.7	4.5	4.7	1.7	0.8	13.4	14.2
1986	4.0	4.2	1.4	1.4	1.5	1.6	4.8	5.0	1.9	0.9	13.6	14.0
1987	3.8	3.8	1.5	1.5	1.6	1.6	4.9	4.9	1.7	0.7	13.4	13.4
1988	4.0	3.9	2.2	2.1	1.7	1.6	4.8	4.6	1.9	1.8	14.6	14.1
1989	4.3	4.0	3.3	3.0	1.8	1.7	4.9	4.5	1.9	1.8	16.2	15.0
1990	4.4	3.9	3.6	3.2	1.9	1.7	5.1	4.6	2.1	1.9	17.1	15.4
1991	4.4	3.8	4.0	3.2	2.1	1.8	5.9	5.0	2.1	1.8	18.6	15.9
1992	4.7	na	4.4	na	2.5	na	6.1	na	2.5	na	20.2	na

Source: Office of Management and Budget, The Budget for Fiscal Year 1992, Historical tables, part seven, pp. 32-40, (Washington, DC: OMB, 1992).

Note: $=Current dollars. '87 $=Constant FY 1987 dollars. Gross domestic product deflators are used to calculate constant dollars. 1992 data are estimates. na=not available.

Related Tables: 7, 10, 26, 66-72, 88, 89, 93.

Table 13.—State and local government expenditures on the environment, 1959-1990.

Year	Natural resources		Parks and recreation		Sewerage		Solid waste management		Total	
	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987
	billion $									
1959	1.08	4.20	0.73	2.85	1.01	3.95	0.60	2.34	3.53	13.78
1960	1.19	4.57	0.77	2.96	1.10	4.24	0.62	2.40	3.82	14.71
1961	1.33	5.05	0.86	3.26	1.10	4.19	0.67	2.56	4.00	15.22
1962	1.37	5.12	0.89	3.31	1.27	4.75	0.69	2.56	4.43	16.54
1963	1.59	5.84	0.98	3.60	1.46	5.38	0.72	2.66	5.00	18.38
1964	1.84	6.62	1.02	3.69	1.52	5.47	0.75	2.71	5.15	18.59
1965	1.86	6.55	1.10	3.89	1.57	5.52	0.79	2.79	5.50	19.38
1966	2.04	6.94	1.19	4.04	1.71	5.81	0.86	2.94	6.10	20.76
1967	2.34	7.74	1.29	4.26	1.64	5.40	0.89	2.93	6.29	20.74
1968	2.47	7.79	1.41	4.45	1.73	5.46	0.98	3.08	6.67	21.04
1969	2.55	7.66	1.65	4.94	1.90	5.69	1.07	3.23	7.17	21.52
1970	2.73	7.78	1.89	5.38	2.17	6.17	1.25	3.55	8.03	22.89
1971	3.08	8.33	2.11	5.70	2.65	7.15	1.44	3.89	9.28	25.08
1972	3.12	8.05	2.32	5.97	3.26	8.40	1.59	4.09	10.29	26.51
1973	3.28	7.94	2.56	6.20	3.60	8.73	1.72	4.16	11.16	27.02
1974	3.66	8.15	2.95	6.57	4.08	9.09	1.92	4.27	12.61	28.08
1975	4.22	8.58	3.46	7.04	5.26	10.70	2.18	4.42	15.12	30.74
1976	4.66	8.91	3.86	7.39	5.94	11.35	2.30	4.40	16.77	32.06
1977	4.05	6.13	4.92	8.80	7.05	12.62	2.37	4.25	18.39	32.91
1978	4.23	7.01	5.27	8.74	7.14	11.84	2.73	4.52	19.36	32.11
1979	4.71	7.18	5.90	9.00	8.80	13.43	2.99	4.57	22.39	34.18
1980	5.51	7.68	6.52	9.09	9.89	13.80	3.32	4.63	25.24	35.21
1981	6.18	7.83	7.06	8.95	11.12	14.10	3.78	4.79	28.14	35.66
1982	6.57	7.84	7.50	8.95	10.81	12.89	4.13	4.93	29.01	34.62
1983	7.08	8.12	8.05	9.23	11.24	12.89	4.36	5.00	30.74	35.25
1984	7.42	8.15	8.34	9.17	11.52	12.66	4.71	5.18	31.99	35.16
1985	8.36	8.85	9.16	9.70	12.19	12.91	5.21	5.52	34.92	36.99
1986	9.07	9.36	10.16	10.49	13.31	13.73	5.84	6.02	38.38	39.61
1987	9.94	9.94	11.02	11.02	15.15	15.15	6.50	6.05	42.61	42.61
1988	10.24	9.85	12.07	11.62	16.33	15.72	7.35	7.07	45.99	44.26
1989	11.09	10.23	12.93	11.93	17.04	15.72	8.73	8.06	49.79	45.93
1990	12.30	10.89	14.25	12.62	18.31	16.22	10.13	8.98	54.99	48.71

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics on Governmental Finances and Employment, GC82(6)-4, (Washington, DC: DOC, 1982).

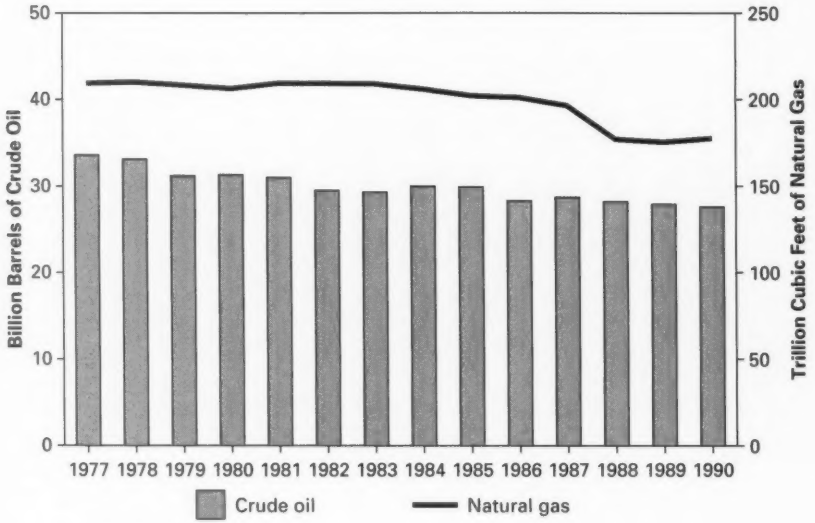
U.S. Department of Commerce, Bureau of the Census, Governmental Finances, series GF No. 5, (Washington, DC: DOC, annual).

Note: Historical trend data are available from 1902-1958, as reported in source above.

Related Tables: 7, 10, 31, 42, 93.

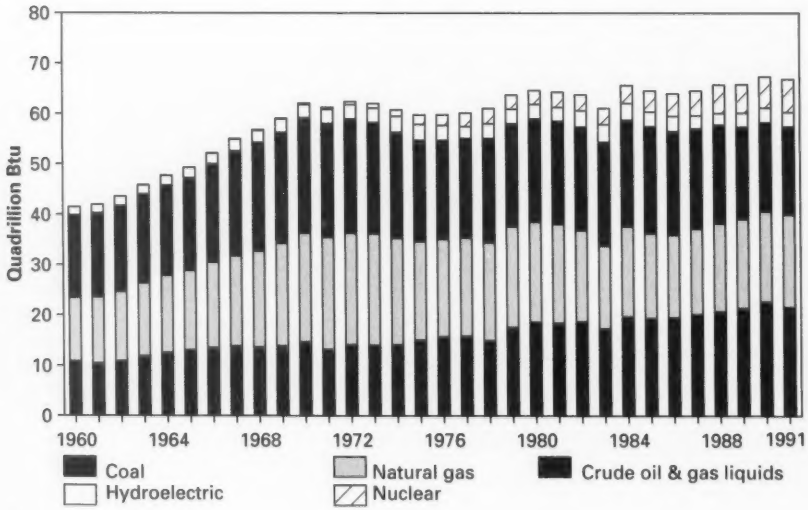
Energy

Figure 8.—U.S. reserves of crude oil and natural gas, 1977-1990.



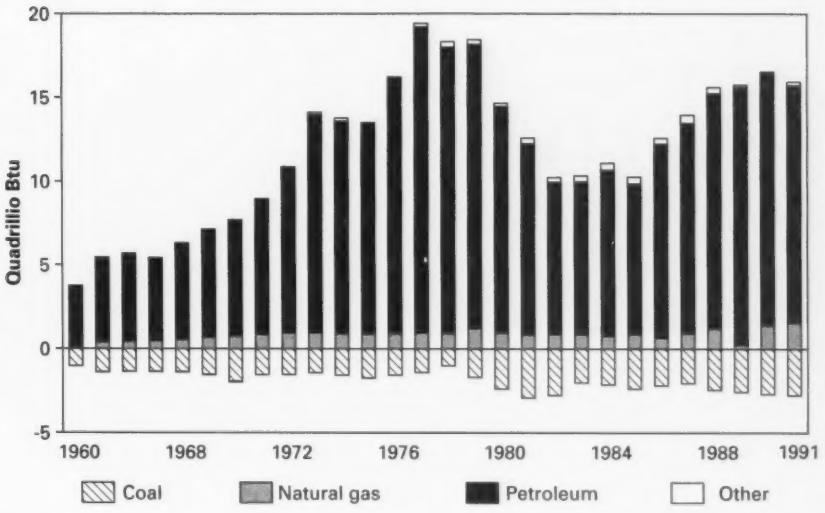
Source: See Table 14.

Figure 9.—U.S. energy production, by source, 1960-1991.



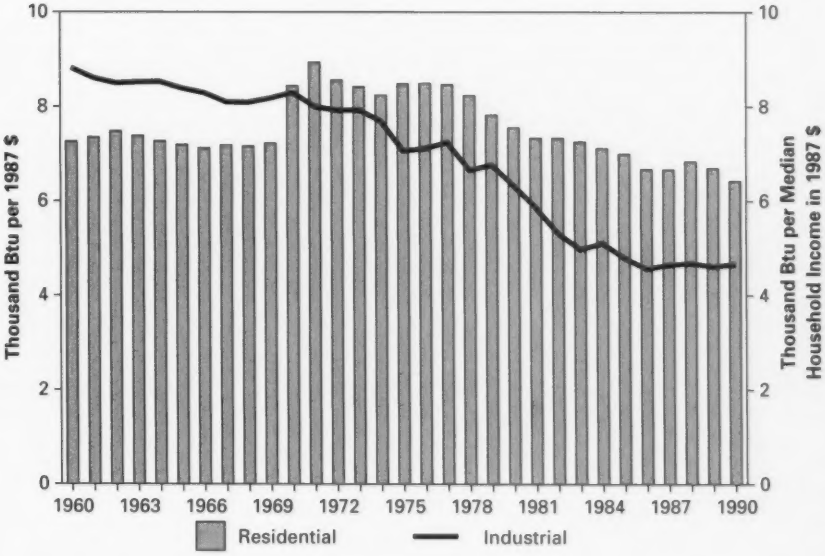
Source: See Table 15.

Figure 10.—Net U.S. imports of energy, 1960-1991.



Source: See Table 21.

Figure 11.—Industrial and residential energy consumption, 1960-1990.



Source: See Table 25.

Table 14.—U.S. energy reserves, by source, 1977-1990.

Year	Natural gas	Crude oil
	trillion cubic feet	*billion barrels*
1977	210	34
1978	210	33
1979	208	31
1980	206	31
1981	209	31
1982	209	30
1983	209	29
1984	206	30
1985	202	30
1986	201	28
1987	196	29
1988	177	28
1989	175	28
1990	178	28

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 42, p. 95, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992)

Notes: Proved reserves of crude oil, natural gas, and natural gas liquids combined increased every year from 1949 to 1968 as new reserves were discovered. Except for the addition of Alaska's North Slope reserves in 1970, proved reserves have trended downward since 1968. Reserves of natural gas alone increased in 1990, largely due to growth in reserves in coalbed methane fields. About one-half of the demonstrated coal reserve base is estimated to be recoverable. Uranium resources include reasonably assured reserves in the forward production cost category of $30.00 per pound or less.

Related Tables: 15-26, 52, 88-89, 97.

Table 15.—U.S. energy production, by source, 1950-1991.

Year	Coal	Crude oil & NPGL	Natural gas	Hydro-electric	Nuclear	Other	Total
			quadrillion Btu				
1950	14.06	12.27	6.23	1.42	0.00	0.01	33.98
1955	12.37	15.65	9.34	1.36	0.00	<0.01	38.73
1960	10.82	16.39	12.66	1.61	0.01	<0.01	41.49
1961	10.45	16.76	13.10	1.66	0.02	<0.01	41.99
1962	10.90	17.11	13.72	1.82	0.03	<0.01	43.58
1963	11.85	17.68	14.51	1.77	0.04	<0.01	45.85
1964	12.52	17.96	15.30	1.89	0.04	<0.01	47.72
1965	13.06	18.40	15.78	2.06	0.04	<0.01	49.34
1966	13.47	19.56	17.01	2.06	0.06	<0.01	52.17
1967	13.83	20.83	17.94	2.35	0.09	0.01	55.04
1968	13.61	21.63	19.07	2.35	0.14	0.01	56.81
1969	13.86	21.98	20.45	2.65	0.15	0.01	59.10
1970	14.61	22.91	21.67	2.63	0.24	0.01	62.07
1971	13.19	22.57	22.28	2.82	0.41	0.01	61.29
1972	14.09	22.64	22.21	2.86	0.58	0.03	62.42
1973	13.99	22.06	22.19	2.86	0.91	0.04	62.06
1974	14.07	21.04	21.21	3.18	1.27	0.05	60.84
1975	14.99	20.10	19.64	3.15	1.90	0.07	59.86
1976	15.65	19.59	19.48	2.98	2.11	0.08	59.89
1977	15.76	19.78	19.57	2.33	2.70	0.09	60.22
1978	14.91	20.68	19.49	2.94	3.02	0.06	61.10
1979	17.54	20.39	20.08	2.93	2.78	0.09	63.80
1980	18.60	20.50	19.91	2.90	2.74	0.11	64.76
1981	18.38	20.46	19.70	2.76	3.01	0.12	64.42
1982	18.64	20.50	18.25	3.27	3.13	0.10	63.89
1983	17.25	20.57	16.53	3.53	3.20	0.13	61.19
1984	19.72	21.12	17.93	3.35	3.55	0.17	65.81
1985	19.33	21.23	16.91	2.94	4.15	0.21	64.76
1986	19.51	20.53	16.47	3.02	4.47	0.23	64.23
1987	20.14	19.89	17.05	2.59	4.91	0.25	64.82
1988	20.74	19.54	17.60	2.31	5.66	0.23	66.08
1989	21.35	18.28	17.85	2.77	5.68	0.22	66.13
1990	22.46	17.74	18.36	2.93	6.16	0.20	67.85
1991	21.55	17.90	18.42	2.88	6.54	0.19	67.49

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 1, p. 7, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Notes: NGPL= Natural gas plant liquids. Other includes electricity produced from geothermal, wood, waste, wind, photovoltaic, and solar thermal sources. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Related Tables: 14, 16-21, 46, 92.

Table 16.—U.S. coal production, by rank and mining method, 1950-1991.

Year	Rank				Mining method	
	Bituminous	Sub-bituminous	Lignite	Anthracite	Underground	Surface
	million metric tons					
1950	468.29	i	i	39.98	381.85	126.42
1955	421.42	i	i	23.77	324.67	120.52
1960	376.87	i	i	17.07	265.37	128.56
1961	365.50	i	i	15.82	253.55	127.77
1962	382.89	i	i	15.32	261.16	137.05
1963	416.25	i	i	16.57	280.24	152.58
1964	441.71	i	i	15.59	297.22	160.07
1965	464.46	i	i	13.48	306.53	171.42
1966	484.23	i	i	11.74	310.75	185.22
1967	501.23	i	i	11.12	319.62	192.73
1968	494.54	i	i	10.40	314.36	190.57
1969	496.29	7.55	4.55	9.50	316.76	201.12
1970	524.67	14.90	7.29	8.82	308.86	246.82
1971	472.86	20.09	7.89	7.92	251.40	257.36
1972	505.06	24.99	9.97	6.45	276.68	269.78
1973	492.98	30.78	12.95	6.19	272.17	270.73
1974	494.94	38.31	14.04	6.00	252.12	301.18
1975	523.81	46.35	17.97	5.63	266.17	327.58
1976	533.65	58.81	23.11	5.65	267.99	353.23
1977	526.96	74.48	25.61	5.32	241.80	390.57
1978	484.36	87.76	31.16	4.57	220.19	387.64
1979	555.34	110.18	38.59	4.39	291.05	417.44
1980	570.29	133.98	42.77	5.49	306.12	446.42
1981	551.44	144.84	45.96	4.92	287.06	460.10
1982	562.49	145.98	47.54	4.16	307.61	452.56
1983	515.73	137.00	52.92	3.71	272.44	436.91
1984	589.09	162.53	57.20	3.77	319.31	493.29
1985	556.92	174.82	65.68	4.26	318.24	483.35
1986	562.55	172.00	69.31	3.90	326.95	480.72
1987	577.42	181.59	71.11	3.27	338.23	495.15
1988	578.78	205.90	79.46	3.18	359.37	524.72
1989	598.47	209.71	78.37	2.99	357.19	532.34
1990	628.81	221.59	79.91	3.18	385.04	548.31
1991	590.76	228.94	78.92	2.63	365.63	535.70

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 84, p. 191, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Note: i=included in bituminous coal. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Related Tables: 14, 15, 19, 21, 22.

Table 17.—U.S. petroleum production and imports, 1940-1991.

Year	Production			Imports	Year	Production			Imports
	Crude oil	NGPL	Total			Crude oil	NGPL	Total	
	million barrels per day					*million barrels per day*			
1940	3.71	0.15	3.93	0.12	1966	8.30	1.28	9.58	2.57
1941	3.84	0.22	4.06	0.14	1967	8.81	1.41	10.22	2.54
1942	3.80	0.23	4.03	0.03	1968	9.12	1.51	10.60	2.84
1943	4.12	0.24	4.37	0.38	1969	9.24	1.59	10.83	3.17
1944	4.60	0.27	4.97	0.12	1970	9.64	1.66	11.30	3.42
1945	4.69	0.31	5.00	0.20	1971	9.46	1.69	11.16	3.93
1946	4.75	0.32	5.07	0.24	1972	9.47	1.75	11.18	4.74
1947	5.09	0.36	5.45	0.27	1973	9.21	1.74	10.95	6.26
1948	5.53	0.40	5.94	0.35	1974	8.77	1.69	10.46	6.11
1949	5.05	0.43	5.05	0.65	1975	8.37	1.63	10.01	6.06
1950	5.41	0.50	5.91	0.85	1976	8.15	1.61	9.74	7.31
1951	6.16	0.56	6.72	0.84	1977	8.24	1.62	9.86	8.81
1952	6.27	0.61	6.87	0.95	1978	8.71	1.57	10.27	8.36
1953	6.46	0.65	7.11	1.03	1979	8.55	1.58	10.14	8.46
1954	6.34	0.69	7.03	1.05	1980	8.60	1.58	10.17	6.91
1955	6.81	0.77	7.58	1.25	1981	8.57	1.61	10.18	6.00
1956	7.17	0.80	7.95	1.44	1982	8.65	1.55	10.20	5.11
1957	7.17	0.81	7.98	1.57	1983	8.69	1.56	10.25	5.05
1958	6.71	0.81	7.52	1.70	1984	8.88	1.63	10.51	5.44
1959	7.05	0.88	7.93	1.78	1985	8.97	1.61	10.58	5.07
1960	7.05	0.93	7.96	1.81	1986	8.68	1.55	10.23	6.22
1961	7.18	0.99	8.17	1.92	1987	8.35	1.60	9.94	6.68
1962	7.33	1.02	8.35	2.08	1988	8.14	1.62	9.76	7.40
1963	7.54	1.10	8.64	2.12	1989	7.61	1.55	9.16	8.06
1964	7.64	1.16	8.77	2.26	1990	7.36	1.56	8.91	8.02
1965	7.80	1.21	9.01	2.47	1991	7.37	1.65	9.02	7.58

Source: Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, series M 143, 138, (Washington, DC: DOC, 1976).

U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1990, table 52, p. 119, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Notes: Crude oil includes lease condensate. NGPL=Natural gas plant liquids. Imports for years 1940-1949 include crude petroleum products only. Previous year data may have been revised. Current-year data are preliminary and may be revised in the future.

Related Tables: 14, 15, 21, 96, 97.

Table 18.—U.S. natural gas production, 1900-1991.

Year	Well production *trillion cubic feet*	Year	Well production *trillion cubic feet*	Year	Well production *trillion cubic feet*
1900	0.13	1931	1.72	1962	13.88
1901	0.18	1932	1.59	1963	14.75
1902	0.21	1933	1.60	1964	15.55
1903	0.24	1934	1.82	1965	16.04
1904	0.26	1935	1.97	1966	17.21
1905	0.32	1936	2.23	1967	18.11
1906	0.39	1937	2.47	1968	19.32
1907	0.41	1938	2.36	1969	20.70
1908	0.40	1939	2.54	1970	21.92
1909	0.48	1940	2.73	1971	22.49
1910	0.51	1941	2.89	1972	22.53
1911	0.51	1942	3.15	1973	22.65
1912	0.56	1943	3.52	1974	21.60
1913	0.58	1944	3.82	1975	20.11
1914	0.59	1945	4.04	1976	19.95
1915	0.63	1946	4.15	1977	20.03
1916	0.75	1947	4.58	1978	19.97
1917	0.80	1948	5.15	1979	20.47
1918	0.72	1949	5.42	1980	20.18
1919	0.75	1950	6.28	1981	19.96
1920	0.81	1951	7.46	1982	18.58
1921	0.67	1952	8.01	1983	16.88
1922	0.78	1953	8.40	1984	18.30
1923	1.03	1954	8.74	1985	17.27
1924	1.16	1955	9.41	1986	16.86
1925	1.21	1956	10.08	1987	17.43
1926	1.34	1957	10.68	1988	17.92
1927	1.47	1958	11.03	1989	18.10
1928	1.60	1959	12.05	1990	18.59
1929	1.95	1960	12.77	1991	18.69
1930	1.98	1961	13.25		

Source: Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, series M 147, (Washington, DC: DOC, 1976).

U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 75, p. 169, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Notes: Production data are for marketed production which includes extraction loss and transfers to natural gas plant liquids. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Related Tables: 14, 15, 21, 22, 25.

Table 19.—U.S. production of electricity, by energy source, 1950-1991.

Year	Coal	Natural gas	Petroleum	Nuclear power	Hydroelectric	Geothermal & other	Total
			billion kilowatthours				
1950	155	45	34	0	96	<1	329
1955	301	95	37	0	113	<1	547
1960	403	158	48	1	146	<1	756
1961	422	169	49	2	152	<1	794
1962	450	184	49	2	169	<1	855
1963	494	202	52	3	166	<1	917
1964	526	220	57	3	177	<1	984
1965	571	222	65	4	194	<1	1,055
1966	613	251	79	6	195	1	1,144
1967	630	265	89	8	222	1	1,214
1968	685	304	104	13	222	1	1,329
1969	706	333	138	14	250	1	1,442
1970	704	373	184	22	248	1	1,532
1971	713	374	220	38	266	1	1,613
1972	771	376	274	54	273	2	1,750
1973	848	341	314	83	272	2	1,861
1974	828	320	301	114	301	3	1,867
1975	853	300	289	173	300	3	1,918
1976	944	295	320	191	284	4	2,038
1977	985	306	358	251	220	4	2,124
1978	976	305	365	276	280	3	2,206
1979	1,075	329	304	255	280	4	2,247
1980	1,162	346	246	251	276	6	2,286
1981	1,203	346	206	273	261	6	2,295
1982	1,192	305	147	283	309	5	2,241
1983	1,259	274	144	294	332	6	2,310
1984	1,342	297	120	328	321	9	2,416
1985	1,402	292	100	384	281	11	2,470
1986	1,386	249	137	414	291	12	2,487
1987	1,464	273	118	455	250	12	2,572
1988	1,541	253	149	527	223	12	2,704
1989	1,554	267	158	529	265	11	2,784
1990	1,560	264	117	577	280	11	2,808
1991	1,548	264	111	613	275	10	2.822

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 92, p. 211, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Notes: Other includes wood, waste, photovoltaic, and solar thermal energy. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Related Tables: 14, 15, 20-24, 26, 37, 38, 92.

Table 20.—U.S. nuclear energy production, 1957-1991.

Year	Operable nuclear generating units	Net generation of electricity	Year	Operable nuclear generating units	Net generation of electricity
	number	*billion kilowatthours*		*number*	*billion kilowatthours*
1957	1	*	1975	54	172.5
1958	1	0.2	1976	61	191.1
1959	1	0.2	1977	65	250.9
1960	3	0.5	1978	70	276.4
1961	3	1.7	1979	68	255.2
1962	5	2.3	1980	70	251.1
1963	6	3.2	1981	74	272.7
1964	6	3.3	1982	77	282.8
1965	6	3.7	1983	80	293.7
1966	8	5.5	1984	86	327.6
1967	10	7.7	1985	95	383.7
1968	11	12.5	1986	100	414.0
1969	14	13.9	1987	107	455.3
1970	18	21.8	1988	108	527.0
1971	21	38.1	1989	110	529.4
1972	29	54.1	1990	111	576.9
1973	39	83.5	1991	111	612.6
1974	48	114.0			

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 105, p. 237, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Note: Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications. *=less than 0.05 billion kilowatthours.

Related Tables: 14, 15, 19, 22.

Table 21.—Net U.S. energy imports, by source, 1950-1991.

Year	Coal	Natural gas	Petroleum	Other	Total
			quadrillion Btu		
1950	-0.78	-0.03	1.24	0.03	0.47
1955	-1.46	-0.02	1.98	0.04	0.54
1960	-1.02	0.15	3.57	0.04	2.74
1965	-1.37	0.44	5.01	- 0.02	4.06
1966	-1.35	0.47	5.21	- 0.01	4.32
1967	-1.35	0.50	4.91	- 0.02	4.04
1968	-1.37	0.58	5.73	- 0.02	4.90
1969	-1.53	0.70	6.42	- 0.02	5.56
1970	-1.93	0.77	6.92	- 0.04	5.72
1971	-1.54	0.88	8.07	*	7.41
1972	-1.53	0.97	9.83	0.05	9.32
1973	-1.42	0.98	12.98	0.14	12.68
1974	-1.57	0.91	12.66	0.19	12.19
1975	-1.74	0.90	12.51	0.08	11.75
1976	-1.57	0.92	15.20	0.09	14.65
1977	-1.40	0.98	18.24	0.20	18.02
1978	-1.00	0.94	17.06	0.33	17.32
1979	-1.70	1.24	16.93	0.27	16.75
1980	-2.39	0.96	13.50	0.18	12.25
1981	-2.92	0.86	11.38	0.33	9.65
1982	-2.77	0.90	9.05	0.28	7.46
1983	-2.01	0.89	9.08	0.36	8.31
1984	-2.13	0.79	9.89	0.40	8.96
1985	-2.39	0.90	8.95	0.41	7.87
1986	-2.19	0.69	11.53	0.35	10.38
1987	-2.05	0.94	12.53	0.48	11.90
1988	-2.45	1.22	14.01	0.36	13.15
1989	-2.57	0.28	15.33	0.14	14.18
1990	-2.70	1.46	15.29	0.03	14.08
1991	-2.77	1.59	14.13	0.21	13.16

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 6, p. 17, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Notes: Net imports=imports minus exports. Other includes coal coke and small amounts of electricity transmitted across U.S. borders with Canada and Mexico. Sum of components may not equal totals because of independent rounding. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications. *=less than 0.005 quadrillion Btu.

Related Tables: 14-19, 22, 88, 89, 92.

Table 22.—U.S. energy consumption, by end-use sector, 1950-1991.

Year	Residential & commercial	Industrial	Transportation	Total
		quadrillion Btu		
1950	8.87	15.71	8.49	33.08
1951	9.30	17.13	9.04	35.47
1952	9.54	16.76	9.00	35.30
1953	9.50	17.65	9.12	36.27
1954	9.78	16.58	8.90	35.27
1955	10.41	18.86	9.55	38.82
1956	10.96	19.55	9.86	40.38
1957	10.98	19.60	9.90	40.48
1958	11.64	18.70	10.00	40.35
1959	12.15	19.64	10.35	42.14
1960	13.04	20.16	10.60	43.80
1961	13.44	20.25	10.77	44.46
1962	14.27	21.04	11.23	46.53
1963	14.71	21.95	11.66	48.32
1964	15.23	23.27	12.00	50.50
1965	16.03	24.22	12.43	52.68
1966	17.06	25.50	13.10	55.66
1967	18.10	25.70	13.75	57.57
1968	19.23	26.90	14.86	61.00
1969	20.59	28.10	15.50	64.19
1970	21.71	28.63	16.09	66.43
1971	22.59	28.57	16.72	67.89
1972	23.69	29.86	17.71	71.26
1973	24.14	31.53	18.60	74.28
1974	23.72	30.69	18.12	72.54
1975	23.90	28.40	18.25	70.55
1976	25.02	30.24	19.10	74.36
1977	25.39	31.08	19.82	76.29
1978	26.09	31.39	20.61	78.09
1979	25.81	32.61	20.47	78.90
1980	25.65	30.61	19.69	75.96
1981	25.24	29.24	19.51	73.99
1982	25.63	26.14	19.07	70.85
1983	25.63	25.75	19.13	70.52
1984	26.50	27.73	19.87	74.10
1985	29.73	27.12	20.10	73.95
1986	26.83	26.64	20.76	74.24
1987	27.62	27.87	21.36	76.84
1988	29.00	29.01	22.19	80.20
1989	29.50	29.45	22.38	81.35
1990	28.86	29.90	22.53	81.29
1991	29.56	29.66	22.29	81.51

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 5, p. 15, DOE/EIA-0384(90), (Washington, DC: DOE, EIA, 1992).

Related Tables: 25, 26.

Table 23.—U.S. energy consumption, per capita, 1950-1991.

Year	Total energy consumption	End-use energy consumption	Year	Total energy consumption	End-use energy consumption
	million Btu			*million Btu*	
1950	219	194	1971	328	270
1951	230	205	1972	340	278
1952	226	199	1973	351	285
1953	228	201	1974	340	273
1954	218	191	1975	327	261
1955	235	206	1976	342	272
1956	240	210	1977	347	274
1957	236	206	1978	352	276
1958	232	202	1979	351	275
1959	238	206	1980	335	259
1960	244	212	1981	322	246
1961	243	210	1982	305	231
1962	250	216	1983	301	225
1963	256	220	1984	313	236
1964	264	226	1985	310	231
1965	272	232	1986	308	229
1966	285	241	1987	316	235
1967	292	246	1988	326	243
1968	306	257	1989	328	242
1969	319	266	1990	327	240
1970	327	270	1991	323	242

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 8, p. 25, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Notes: End-use energy consumption is total energy consumption less losses incurred in the generation, transmission, and distribution of electricity, less powerplant electricity use and unaccounted for electrical system energy losses. Per capita data are based upon the resident population of 50 states census and the District of Colombia, estimated for July 1 of each year, except for April decennial census years. Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Related Tables: 1, 6, 22, 25, 26, 88, 89.

Table 24.—U.S. energy consumption, per dollar of GDP, 1959-1991.

Year	Petroleum & natural gas	Other energy	Total	Year	Petroleum & natural gas	Other energy	Total
	thousand Btu per 1987 $				*thousand Btu per 1987 $*		
1959	16.07	5.75	21.83	1976	16.42	5.57	22.00
1960	16.37	5.83	22.20	1977	16.15	5.44	21.59
1961	16.36	5.59	21.95	1978	15.65	5.43	21.09
1962	16.33	5.52	21.85	1979	15.22	5.56	20.78
1963	16.28	5.51	21.79	1980	14.46	5.66	20.11
1964	16.04	5.51	21.55	1981	13.49	5.76	19.25
1965	15.77	5.53	21.30	1982	12.96	5.88	18.84
1966	15.79	5.44	21.23	1983	12.14	5.92	18.02
1967	16.07	5.33	21.40	1984	11.95	5.92	17.86
1968	16.49	5.29	21.78	1985	11.39	5.89	17.28
1969	17.04	5.27	22.31	1986	11.10	5.75	16.85
1970	17.84	5.26	23.10	1987	11.15	5.78	16.93
1971	17.92	5.02	22.94	1988	11.18	5.81	17.00
1972	17.91	5.03	22.92	1989	11.08	5.74	16.82
1973	17.55	5.18	22.73	1990	10.82	5.82	16.64
1974	16.99	5.34	22.33	1991	10.90	5.91	16.81
1975	16.35	5.55	21.90				

Source: U.S. Department of Energy, Energy Information Administration, Annual Energy Review 1991, table 9, p. 27, DOE/EIA-0384(91), (Washington, DC: DOE, EIA, 1992).

Note: Previous year data may have been revised. Current-year data are preliminary and may be revised in future publications.

Related Tables: 7, 23, 25, 26.

Table 25.—Industrial and residential energy consumption, 1960-1990.

Year	End-use industrial consumption	Residential household consumption	Year	End-use industrial consumption	Residential household consumption
	thousand Btu per 1987 $	*thousand Btu per median household income in 1987 $*		*thousand Btu per 1987 $*	*thousand Btu per median household income in 1987 $*
1960	8.82	7.26	1976	7.11	8.49
1961	8.61	7.35	1977	7.24	8.46
1962	8.50	7.48	1978	6.65	8.23
1963	8.52	7.38	1979	6.76	7.82
1964	8.53	7.27	1980	6.32	7.55
1965	8.39	7.19	1981	5.86	7.33
1966	8.29	7.12	1982	5.32	7.33
1967	8.10	7.18	1983	4.97	7.25
1968	8.09	7.16	1984	5.11	7.11
1969	8.18	7.22	1985	4.79	6.99
1970	8.30	8.44	1986	4.56	6.67
1971	8.00	8.93	1987	4.65	6.66
1972	7.92	8.56	1988	4.68	6.83
1973	7.93	8.42	1989	4.61	6.69
1974	7.69	8.24	1990	4.67	6.42
1975	7.06	8.48			

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report: Consumption Estimates 1960-1990, table 13, p. 32, and table 15, p. 34, DOE/EIA-0214(90), (Washington, DC: DOE, EIA, 1992).

Notes: End-use energy consumption is total energy consumption less losses incurred in the generation, transmission, and distribution of electricity, less power plant electricity use and unaccounted for electrical system energy losses. GDP data are from Table 7. Household data are from the Bureau of the Census, Statistical Abstract of the United States, (Washington, DC: DOC, BOC, annual).

Related Tables: 7, 15, 17, 22, 23, 26.

Table 26.—Energy expenditure estimates, by sector, 1970-1990.

Year	Residential	Commercial	Industry	Transportation	Electric utility
			dollars per million Btu		
1970	2.12	1.97	0.83	2.31	0.32
1973	2.73	2.60	1.08	2.59	0.49
1974	3.40	3.45	1.77	3.72	1.03
1975	3.84	4.09	2.20	4.02	0.96
1976	4.17	4.46	2.39	4.21	1.03
1977	4.82	5.21	2.75	4.49	1.19
1978	5.19	5.65	2.98	4.62	1.29
1979	6.01	6.24	3.58	6.21	1.48
1980	7.55	7.88	4.71	8.61	1.75
1981	8.93	9.65	5.35	9.78	2.00
1982	9.80	10.51	5.93	9.40	2.01
1983	10.85	11.05	6.30	8.44	1.98
1984	10.86	11.29	6.21	8.24	1.97
1985	11.14	11.71	6.09	8.26	1.85
1986	10.99	11.35	5.40	6.22	1.55
1987	11.95	11.05	5.20	6.58	1.51
1988	10.90	10.90	5.03	6.56	1.45
1989	11.26	11.38	5.15	7.20	1.48
1990	12.14	11.95	5.49	8.33	1.46

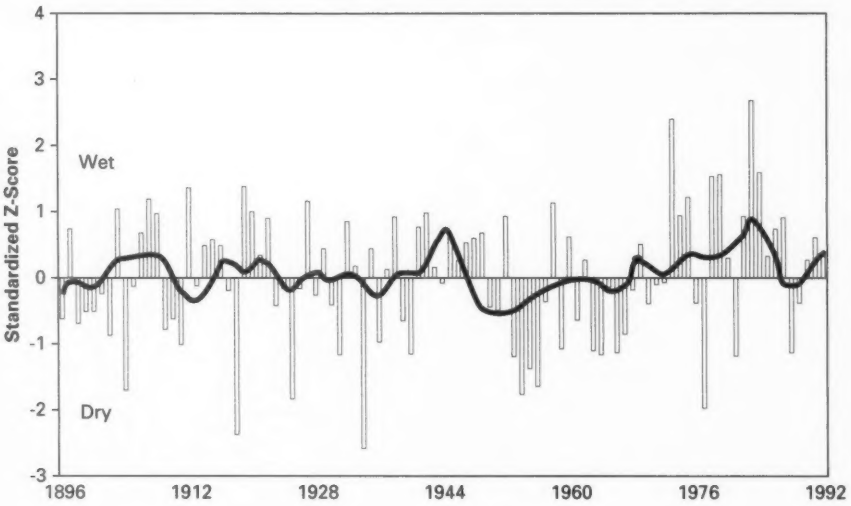
Source: U.S. Department of Energy, Energy Information Administration, State Energy Price and Expenditure Report 1990, p. 20, DOE/EIA-0376(90), (Washington, DC: DOE, EIA, 1992).

Notes: There are no direct fuel costs for hydroelectric, geothermal, centralized solar, or wind energy. Wood and other biomass fuels are not included, except those consumed at electric utilities. Data for 1971 and 1972 not available.

Related Tables: 22, 24, 25.

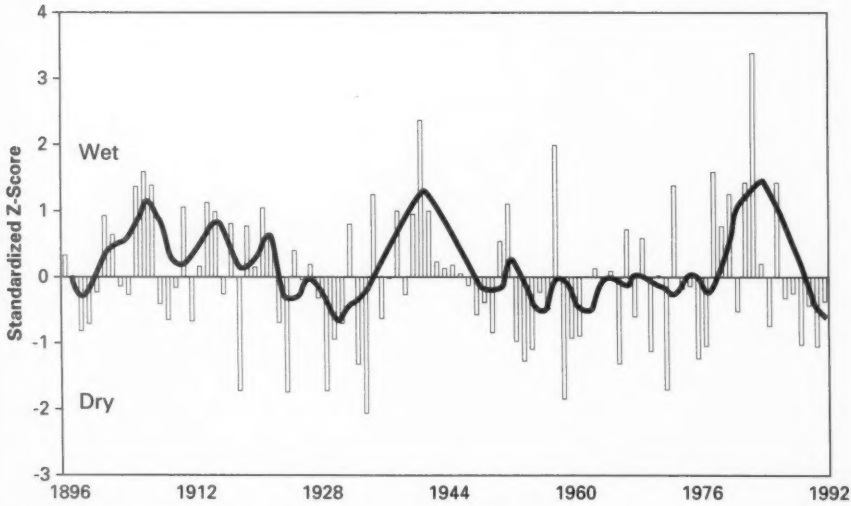
Water

Figure 12a.—Precipitation index for the United States, 1896-1992.



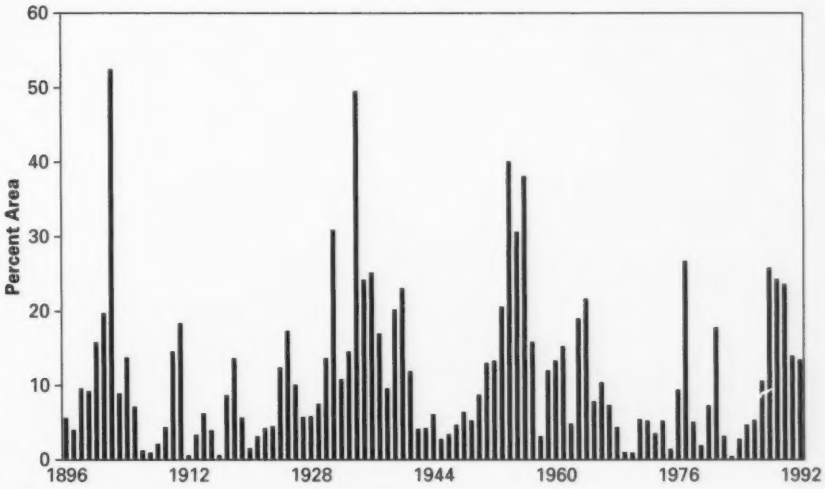
Note: Calculated for the wet season (September through May).
Source: See Table 27.

Figure 12b.—Precipitation index for the western United States, 1896-1992.



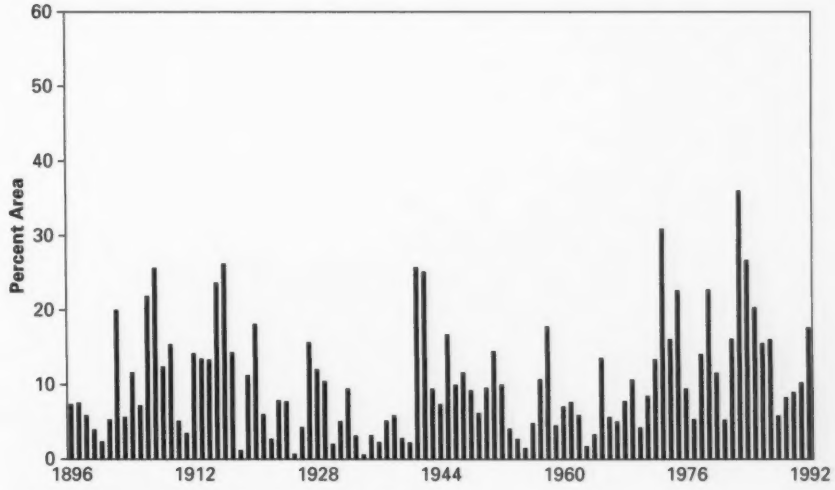
Note: Calculated for the wet season (September through May).
Source: See Table 27.

Figure 13a.—Severe to extreme drought in the conterminous United States, 1896-1992.



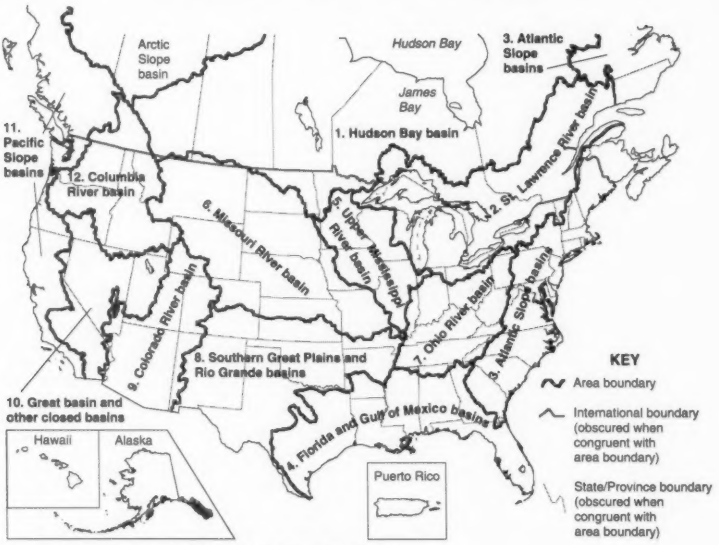
Note: Based on the Palmer Drought Severity Index.
Source: See Table 28.

Figure 13b.—Severe to extreme wetness in the conterminous United States, 1896-1992.



Note: Based on the Palmer Drought Severity Index.
Source: See Table 28.

Figure 14a.—National water conditions hydrologic areas.


Arctic Slope basin
Hudson Bay
James Bay
3. Atlantic Slope basins
1. Hudson Bay basin
11. Pacific Slope basins
12. Columbia River basin
2. St. Lawrence River basin
6. Missouri River basin
5. Upper Mississippi River basin
9. Colorado River basin
7. Ohio River basin
3. Atlantic Slope basins
8. Southern Great Plains and Rio Grande basins
10. Great basin and other closed basins
4. Florida and Gulf of Mexico basins
Hawaii
Alaska
Puerto Rico
KEY
Area boundary
International boundary (obscured when congruent with area boundary)
State/Province boundary (obscured when congruent with area boundary)

Source: U.S. Department of the Interior, Geological Survey.

Figure 14b.—Monthly departure of actual streamflow (1985-1992) from median streamflow (1951-1980).

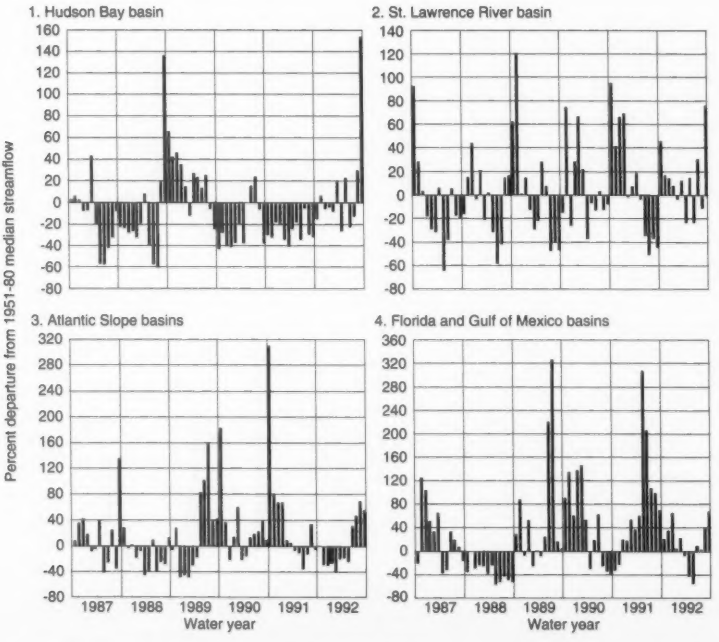
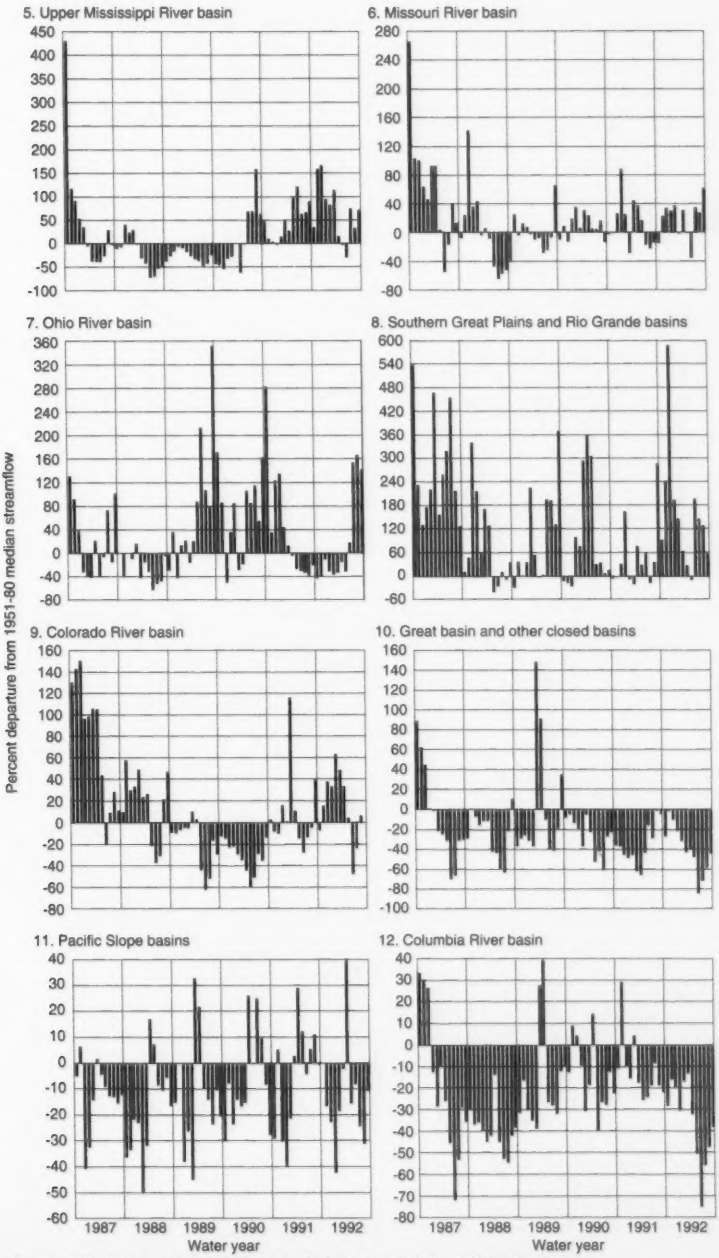


Figure 14b. (continued)—Monthly departure of actual streamflow (1985-1992) from median streamflow (1951-1980).


5. Upper Mississippi River basin
6. Missouri River basin
7. Ohio River basin
8. Southern Great Plains and Rio Grande basins
9. Colorado River basin
10. Great basin and other closed basins
11. Pacific Slope basins
12. Columbia River basin
Percent departure from 1951-80 median streamflow
1987 1988 1989 1990 1991 1992
Water year

Source: U.S. Department of the Interior, Geological Survey, *National Water Conditions*.

Table 27.—Precipitation index for the United States and western United States, 1896-1992.

Year	United States	Western United States	Year	United States	Western United States	Year	United States	Western United States
	standardized-Z score			*standardized-Z score*			*standardized-Z score*	
1896	-0.62	0.33	1929	0.44	-1.72	1962	0.27	0.01
1897	0.74	-0.03	1930	-0.41	-0.94	1963	-1.10	0.13
1898	-0.69	-0.82	1931	-1.16	-0.70	1964	-1.16	-0.08
1899	-0.51	-0.71	1932	0.85	0.80	1965	-0.14	0.09
1900	-0.51	-0.23	1933	0.18	-1.32	1966	-1.13	-1.31
1901	-0.24	0.93	1934	-2.58	-2.06	1967	-0.85	0.72
1902	-0.87	0.64	1935	0.44	1.25	1968	-0.18	-0.60
1903	1.04	-0.14	1936	-0.97	-0.63	1969	0.51	0.59
1904	-1.70	-0.27	1937	0.13	-0.02	1970	-0.39	-1.12
1905	-0.13	1.37	1938	0.92	1.00	1971	-0.10	0.02
1906	0.68	1.59	1939	-0.65	-0.27	1972	-0.07	-1.70
1907	1.19	1.39	1940	-1.15	0.95	1973	2.40	1.39
1908	0.97	-0.41	1941	0.77	2.37	1974	0.94	-0.18
1909	-0.78	-0.65	1942	0.98	1.00	1975	1.22	-0.14
1910	-0.62	-0.16	1943	0.16	0.23	1976	-0.38	-1.23
1911	-1.01	1.06	1944	-0.08	0.13	1977	-1.97	-1.04
1912	1.36	-0.67	1945	0.63	0.18	1978	1.53	1.59
1913	-0.12	0.16	1946	0.26	0.05	1979	1.56	0.77
1914	0.49	1.13	1947	0.53	-0.13	1980	0.30	1.26
1915	0.58	0.99	1948	0.60	-0.57	1981	-1.18	-0.52
1916	0.49	-0.26	1949	0.68	-0.39	1982	0.93	1.43
1917	-0.19	0.81	1950	-0.44	-0.84	1983	2.68	3.39
1918	-2.37	-1.72	1951	-0.49	0.54	1984	1.59	0.20
1919	1.38	0.77	1952	0.93	1.11	1985	0.33	-0.74
1920	1.00	0.15	1953	-1.19	-0.97	1986	0.74	1.43
1921	0.34	1.05	1954	-1.76	-1.27	1987	0.91	-0.32
1922	0.90	0.64	1955	-1.37	-1.09	1988	-1.13	-0.25
1923	-0.42	-0.69	1956	-1.64	-0.23	1989	-0.38	-1.02
1924	-0.16	-1.74	1957	-0.36	-0.49	1990	0.27	-0.43
1925	-1.83	0.40	1958	1.13	1.99	1991	0.61	-1.05
1926	-0.16	-0.04	1959	-1.07	-1.84	1992	0.33	-0.37
1927	1.16	0.19	1960	0.62	-0.92			
1928	-0.26	-0.32	1961	-0.64	-0.89			

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, (Ashville, NC: NCDC, 1992).

Notes: To produce the standardized-Z score, the annual precipitation for each climate division in the United States is first standardized by gamma distribution, then weighted by area to calculate a regional precipitation index. The regional values are averaged to calculate a national mean standardized precipitation index. A 9-point binomial filter (not shown above,but graphed as a solid line in Figures 9a and 9b) is applied to average out year-to-year fluctuations and show longer-term variations. As indicated above, the western region(California and Nevada) has been consistently dry (-) since the 1986-87 rainy season. Negative Z scores indicate dry periods.

Related Tables: 5, 28, 29, 44, 55.

Table 28.—Severe to extreme drought and wetness in the conterminous United States, 1896-1992.

Year	Severe/ extreme drought	Severe/ extreme wetness	Year	Severe/ extreme drought	Severe/ extreme wetness	Year	Severe/ extreme drought	Severe/ extreme wetness
	% area			*% area*			*% area*	
1896	5.60	7.33	1929	7.47	10.38	1962	4.81	5.86
1897	3.98	7.53	1930	13.58	2.00	1963	18.90	1.67
1898	9.58	5.83	1931	30.81	5.04	1964	21.53	3.28
1899	9.18	3.93	1932	10.77	9.40	1965	7.76	13.50
1900	15.74	2.32	1933	14.49	3.11	1966	10.31	5.58
1901	19.64	5.28	1934	49.47	0.55	1967	7.26	5.00
1902	52.42	19.96	1935	24.08	3.15	1968	4.33	7.73
1903	8.87	5.59	1936	25.08	2.23	1969	0.92	10.58
1904	13.72	11.58	1937	16.88	5.07	1970	0.86	4.19
1905	7.08	7.15	1938	9.53	5.80	1971	5.38	8.41
1906	1.18	21.78	1939	20.11	2.78	1972	5.18	13.30
1907	0.89	25.59	1940	22.96	2.18	1973	3.46	30.83
1908	2.07	12.33	1941	11.84	25.67	1974	5.17	16.00
1909	4.33	15.34	1942	4.08	25.04	1975	1.36	22.52
1910	14.50	5.08	1943	4.20	9.40	1976	9.32	9.39
1911	18.27	3.44	1944	6.05	7.33	1977	26.59	5.31
1912	0.53	14.13	1945	2.73	16.63	1978	5.01	13.99
1913	3.31	13.40	1946	3.37	9.89	1979	1.85	22.64
1914	6.18	13.28	1947	4.63	11.56	1980	7.21	11.49
1915	3.93	23.57	1948	6.33	9.18	1981	17.70	5.22
1916	0.55	26.15	1949	5.23	6.12	1982	3.11	16.05
1917	8.61	14.27	1950	8.66	9.50	1983	0.38	35.99
1918	13.56	1.16	1951	12.93	14.39	1984	2.73	26.61
1919	5.63	11.19	1952	13.23	9.93	1985	4.63	20.23
1920	1.49	18.04	1953	20.50	4.03	1986	5.28	15.47
1921	3.09	5.98	1954	40.00	2.68	1987	10.51	15.98
1922	4.20	2.68	1955	30.54	1.45	1988	25.71	5.78
1923	4.46	7.83	1956	38.03	4.79	1989	24.18	8.22
1924	12.34	7.67	1957	15.76	10.62	1990	23.51	8.93
1925	17.22	0.64	1958	3.09	17.70	1991	12.21	10.73
1926	10.00	4.24	1959	11.94	4.48	1992	13.39	17.55
1927	5.70	15.61	1960	13.26	7.01			
1928	5.81	11.98	1961	15.16	7.61			

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Climatic Data Center, (Ashville, NC: NCDC, 1992).

Notes: The Palmer Drought Severity Index (PDSI) is used to measure long-term drought and wet conditions. The PDSI is calculated for each climate division in the conterminous United States. This table presents the percent area of the country experiencing severe to extreme long-term drought and wet conditions.

Related Tables: 5, 27, 29, 33, 44, 55.

Table 29.—Offstream water use, by source and end-use sector, 1900-1990.

Year	Source		End-use sector					
	Ground-water	Surface water	Public supply	Rural & domestic livestock	Irrigation	Thermo-electric utility	Commercial and industrial	Total
	billion gallons per day							
1900	na	na	3.0	2.0	20.0	5.0	10.0	40.0
1910	na	na	5.0	2.2	39.0	7.0	14.0	67.2
1920	na	na	6.0	2.4	56.0	9.0	18.0	91.4
1930	na	na	8.0	2.9	60.0	18.0	21.0	109.9
1940	na	na	10.0	3.1	71.0	23.0	29.0	136.1
1945	na	na	12.0	3.4	80.0	31.5	35.0	161.9
1950	34.0	150.0	14.0	3.6	89.0	40.0	37.0	183.6
1955	47.6	198.0	17.0	3.6	110.0	72.0	39.0	241.6
1960	50.4	221.0	21.0	3.6	110.0	100.0	38.0	272.6
1965	60.5	253.0	24.0	4.0	120.0	130.0	46.0	324.0
1970	69.0	303.0	27.0	4.5	130.0	170.0	47.0	378.5
1975	83.0	329.0	29.0	4.9	140.0	200.0	45.0	418.9
1980	83.9	361.0	34.0	5.6	150.0	210.0	45.0	444.6
1985	73.7	320.0	37.0	7.8	140.0	190.0	31.0	405.8
1990	80.6	327.0	38.5	7.9	137.0	195.5	29.9	408.8

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, series J 92-103, (Washington, DC: DOC, 1976).

Solley, W.B. & R.R. Pierce, Preliminary Estimates of Water Use in the United States, 1990, U.S. Department of the Interior, Geological Survey Open File Report 92-63, (Reston, VA: DOI, USGS, 1992).

Solley, W.B., C.F. Merk & R.R. Pierce, Estimated Use of Water in the United States in 1985, U.S. Department of the Interior, Geological Survey Circular 1004, and earlier reports in this series, (Reston, VA: DOI, USGS, 1988).

Note: na=not available.

Related Tables: 19, 30, 31, 53-55, 97, 98.

Table 30.—Designated-use support in surface waters of the United States, 1990.

Designated-use support	Rivers	Lakes & reservoirs	Estuaries
	miles	*acres*	*square miles*
Fully supporting	407,162	8,173,917	15,004
Threatened	43,214	2,902,809	3,052
Partially supporting	134,472	3,471,633	6,573
Not supporting	62,218	3,940,277	2,064
Not assessed	1,153,000	20,910,000	8,931
Total	1,800,000	39,400,000	35,624

Source: U.S. Environmental Protection Agency, National Water Quality Inventory: 1990 Report to Congress, (Washington, DC: EPA, 1992).

Related Tables: 31-35, 53-55, 77, 82, 83, 97, 98.

Table 31.—Causes and sources of pollution in surface waters of the United States, 1990.

Causes of pollution	Rivers	Lakes & reservoirs	Estuaries
	impaired miles	*impaired acres*	*impaired square miles*
Siltation	67,059	702,857	312
Nutrients	51,747	1,793,022	3,279
Organic enrichment	47,545	1,072,184	1,876
Pathogens	35,151	129,286	1,781
Metals	28,287	2,672,427	431
Salinity	21,914	243,482	nr
Habitat modification	20,258	nr	nr
Pesticides	20,701	nr	105
Priority organics	nr	247,317	917
Suspended solids	20,819	731,993	467
Flow alteration	15,565	677,413	nr
pH	9,368	192,153	36

Sources of pollution	Rivers	Lakes & reservoirs	Estuaries
	impaired miles	*impaired acres*	*impaired square miles*
Agriculture	103,439	1,996,772	1,074
Municipal	27,994	593,518	2,038
Habitat modification	24,884	1,407,827	307
Resource extraction	24,015	301,398	91
Storm sewers/runoff	18,129	973,077	1,790
Industrial	15,568	318,446	615
Silviculture	15,459	106,502	89
Construction	9,810	106,398	640
Land disposal	7,188	846,892	1,137
Combined sewers	2,836	3,015	359
Unknown	9,266	403,080	189

Source: U.S. Environmental Protection Agency, National Water Quality Inventory: 1990 Report to Congress, (Washington, DC: EPA, 1992).

Notes: nr=not reported. In addition to the above, thermal modifications impair 9,970 river miles. Taste and odor impairments affect 105,288 acres of lakes and reservoirs and noxious aquatic plants impair 711,323 acres. Additional causes of pollution in estuaries are ammonia (50 square miles), oil and grease (36 square miles), and unknown (109 square miles). Estimates of impairment are based on the sums of partially and not supporting designated uses in Table 30 which represent 9.5% of total U.S. river miles, 8.9% of total U.S. lake acres, and 16.7% of total U.S. estuary square miles.

Related Tables: 30, 32-35, 39, 50, 53, 54, 56, 77, 82, 83, 95-98.

Table 32.—National ambient water quality in rivers and streams: violation rates, 1975-1989.

Year	Fecal coliform bacteria	Dissolved oxygen	Total phosphorus	Total cadmium, dissolved	Total lead, dissolved
	percent of all measurements exceeding water quality criteria				
1975	36	5	5	*	*
1976	32	6	5	*	*
1977	34	11	5	*	*
1978	35	5	5	*	*
1979	34	4	3	4	13
1980	31	5	4	1	5
1981	30	4	4	1	3
1982	33	5	3	1	2
1983	34	4	3	1	5
1984	30	3	3	<1	<1
1985	28	3	3	<1	<1
1986	24	3	3	<1	<1
1987	23	2	2	<1	<1
1988	22	2	2	<1	<1
1989	20	3	3	<1	<1

Source: U.S. Geological Survey, national-level unpublished data derived from state-level data reported in Water-Data Reports, an annual series prepared in cooperation with state governments.

Note: Violation levels are based on U.S. Environmental Protection Agency water quality criteria: fecal coliform bacteria—above 200 cells per 100 ml; dissolved oxygen—below 5 mg per liter; total phosphorus—above 1.0 mg per liter; cadmium, dissolved—above 10 ug per liter; lead, dissolved—above 50 ug per liter. *=base figure too small to meet statistical standards for reliability of derived figures.

Related Tables: 30, 31, 33-35, 53.

Table 33.—Trends in stream water quality, 1978-1987.

Water quality indicators	NASQAN* stations analyzed	Flow-adjusted concentrations		
		Upward trend	Downward trend	No trend
		number of stations		
Common ions	393	91	42	260
Calcium	393	50	31	312
Magnesium	392	76	25	291
Sodium	393	55	29	309
Potassium	393	42	54	297
Sulfate	393	34	36	293
Chloride	392	65	32	295
Dissolved solids	388	84	22	282
Nutrients and suspended solids	389	67	61	261
Nitrogen	390	82	24	284
Phosphorus	389	12	69	308
Suspended solids	153	13	19	121
Dissolved oxygen deficit & bacteria	380	25	52	302
Oxygen deficit	316	12	39	265
Fecal coliform	390	24	51	315
Fecal streptococcus	366	20	36	310
Acidity and alkalinity	385	115	12	258
Acidity	387	91	12	284
Total alkalinity	385	82	9	298

Source: Lettenmaier, D.P., E.R. Hooper, C. Wagoner, and K.B. Faris, Trends in stream water quality in the continental United States, 1978-1987, p. 333. Water Resources Research (March 1991).

Note: *Analyses were made on data from the U.S. Geological Survey's National Stream Quality Accounting Network (NASQAN) stations.

Related Tables: 29-32, 53, 54.

Table 34.—Estimated phosphorus loadings to the Great Lakes, 1976-1989.

Year	Lake Superior	Lake Michigan	Lake Huron	Lake Erie	Lake Ontario
			metric tons		
1976	3,550	6,656	4,802	18,480	12,695
1977	3,661	4,666	3,763	14,576	8,935
1978	5,990	6,245	5,255	19,431	9,547
1979	6,619	7,659	4,881	11,941	8,988
1980	6,412	6,574	5,307	14,855	8,579
1981	3,412	4,091	3,481	10,452	7,437
1982	3,160	4,084	4,689	12,349	8,891
1983	3,407	4,515	3,978	9,880	6,779
1984	3,642	3,611	3,452	12,874	7,948
1985	2,864	3,956	5,758	11,216	7,083
1986	3,059	4,981	4,210	11,118	9,561
1987	1,949	3,298	2,909	8,381	7,640
1988	2,067	2,907	3,165	7,841	6,521
1989	2,323	4,360	3,227	8,568	6,723

Source: Great Lakes Water Quality Board, Great Lakes Water Quality Surveillance Subcommittee Reports to the International Joint Commission, United States and Canada, (Windsor, ON, Canada: IJC, biennial).

Note: The 1978 Great Lakes Water Quality Agreement set target loadings for each lake (in metric tons per year): Lake Superior 3,400; Lake Michigan 5,600; Lake Huron 4,360; Lake Erie 11,000; and Lake Ontario 7,000.

Related Tables: 30, 31, 50, 53.

Table 35.—Shellfish bed closures, by region, 1966-1990.

Year	Northeast	Southeast	Gulf of Mexico	Pacific
	thousand prohibited acres			
1966	443.1	790.0	523.7	3.4
1971	710.4	1,702.4	592.1	317.4
1974	710.8	1,896.6	829.1	316.8
1980	781.8	877.9	889.1	317.5
1985	709.1	612.0	1,649.0	157.0
1990	1,020.0	630.0	2,405.0	183.0

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Survey, Ocean Assessments Division, Strategic Assessment Branch, Trends in Harvest-Limited Shellfish Areas (Rockville, MD: Data compiled from the National Estuarine Inventory database).

Related Tables: 5, 6, 31, 32, 65, 97.

Table 36.—Sea level trends for selected coastal areas in the United States, 1930-1980.

Coast and station	Latitude	Trend*
Atlantic Coast	*degrees North*	*millimeters per year*
Key West, FL	24.5	2.4
Miami, FL	25.8	2.8
Mayport, FL	30.5	2.6
Charleston, SC	32.8	3.2
Portsmouth, VA	36.8	2.5
Hampton Roads, VA	37.0	2.9
Washington, DC	38.8	1.9
Annapolis, MD	39.0	2.5
Baltimore, MD	39.2	2.2
Atlantic City, NJ	39.3	2.2
Philadelphia, PA	40.0	1.3
New York, NY	40.7	2.0
Willets Point, NY	40.8	1.3
Newport, RI	41.5	1.1
Boston, MA	42.3	0.6
Portland, ME	43.7	1.8
Pacific Coast	*degrees North*	*millimeters per year*
San Diego, CA	32.4	0.7
La Jolla, CA	32.5	2.3
Los Angeles, CA	33.4	1.1
San Francisco, CA	37.5	1.6
Seattle, WA	47.4	3.2
Friday Harbor, WA	48.3	1.7
Honolulu, HI	21.2	2.0

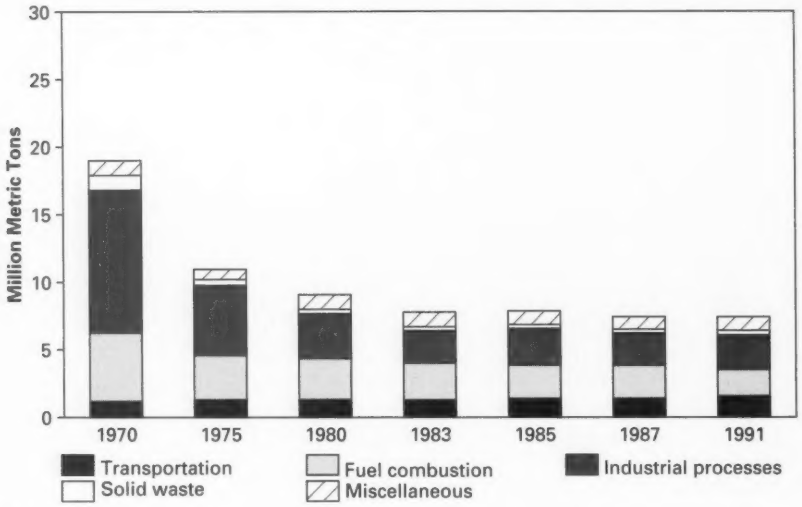
Source: Douglas, B.C., Global sea level rise, Journal of Geophysical Research, 96(C4): 6981-6992, (April 1991).

*Corrected for postglacial rebound.

Related Tables: 38, 44.

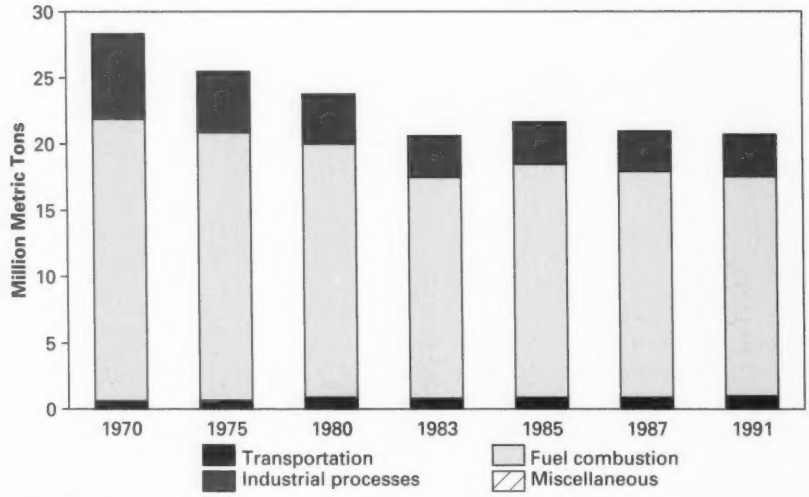
Air Quality

Figure 15a.—U.S. emissions of particulates, by source, 1970-1991.



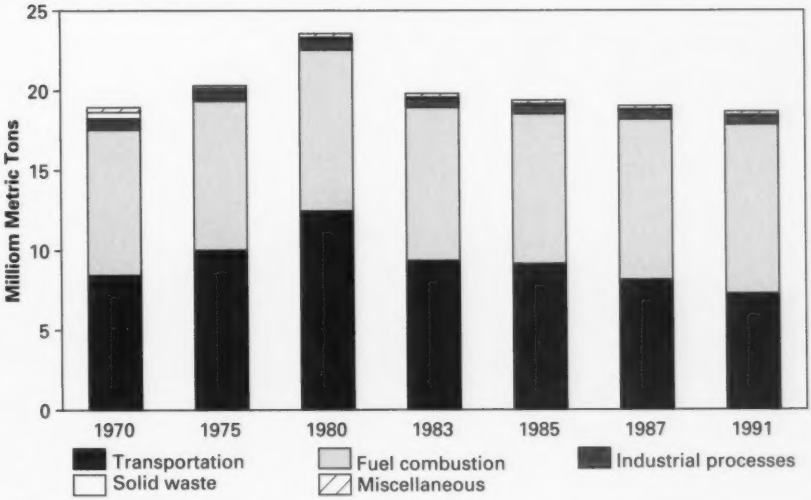
Source: See Table 37.

Figure 15b.—U.S. emissions of sulfur oxides, by source, 1970-1991.



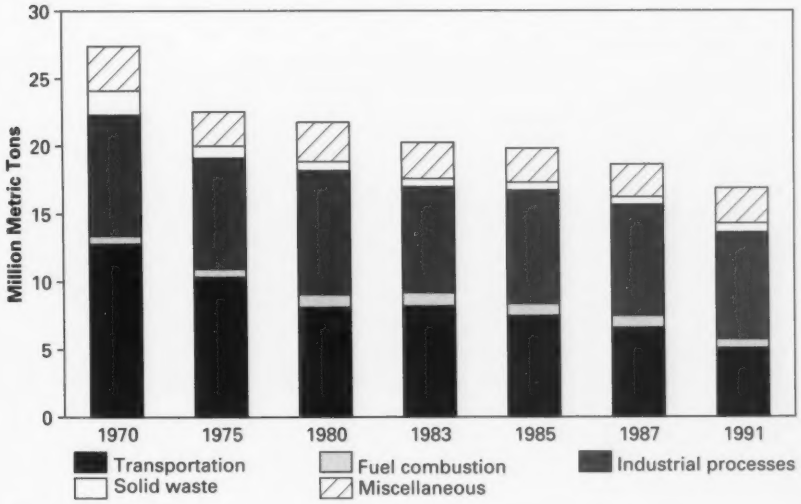
Source: See Table 37.

Figure 15c.—U.S. emissions of nitrogen oxides, by source, 1970-1991.



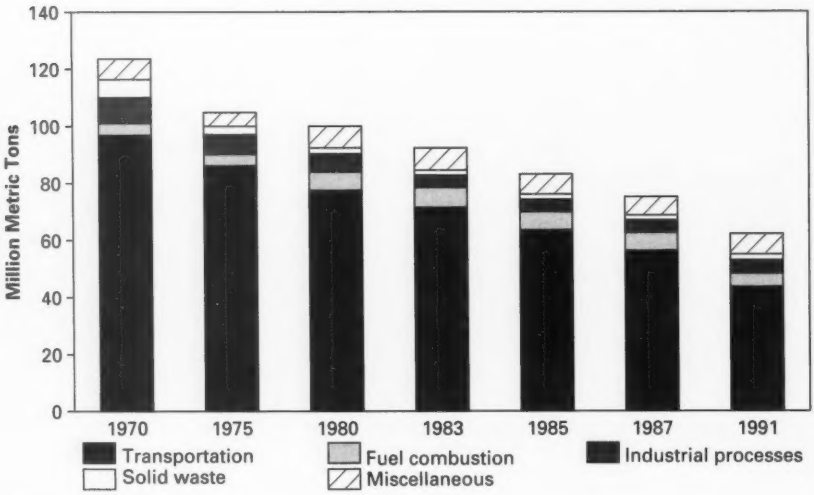
Source: See Table 37.

Figure 15d.—U.S. emissions of volatile organic compounds, by source, 1970-1991.



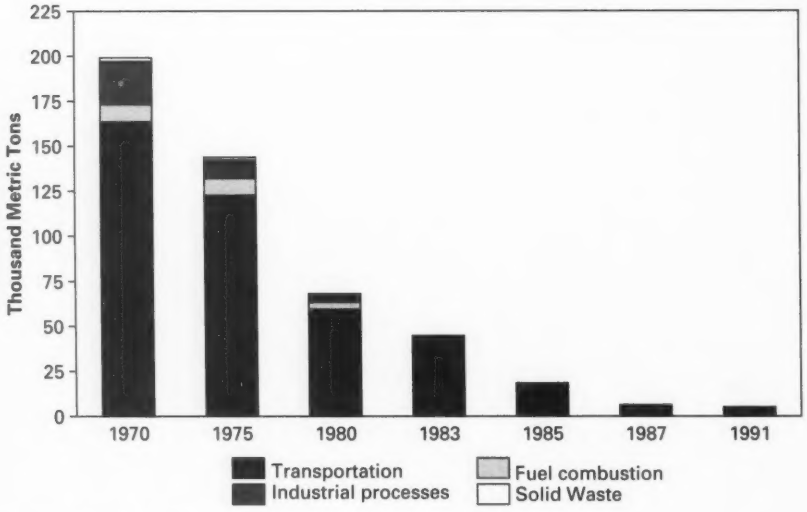
Source: See Table 37.

Figure 15e.—U.S. emissions of carbon monoxide, by source, 1970-1991.



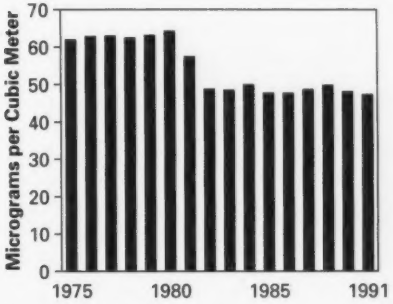
Source: See Table 37.

Figure 15f.—U.S. emissions of lead, by source, 1970-1991.



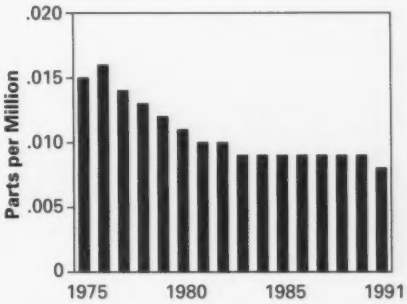
Source: See Table 37.

Figure 16a.—National ambient concentrations of particulates, 1975-1991.



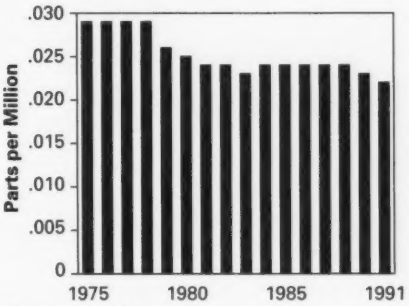
Source: See Table 40.

Figure 16b.—National ambient concentrations of sulfur dioxide, 1975-1991.



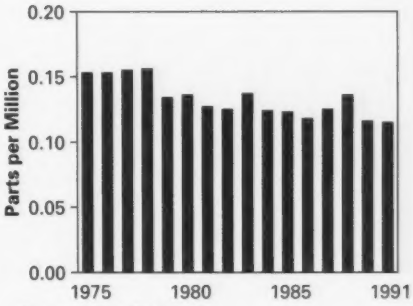
Source: See Table 40.

Figure 16c.—National ambient concentrations of nitrogen dioxide, 1975-1991.



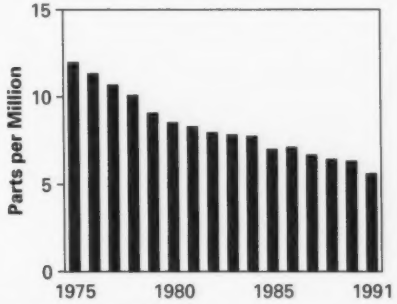
Source: See Table 40.

Figure 16d.—National ambient concentrations of ozone, 1975-1991.



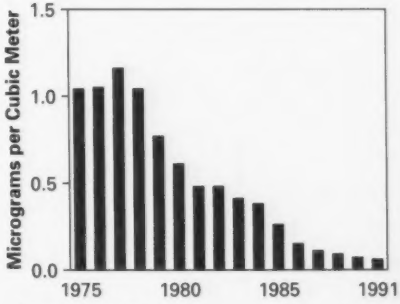
Source: See Table 40.

Figure 16e.—National ambient concentrations of carbon monoxide, 1975-1991.



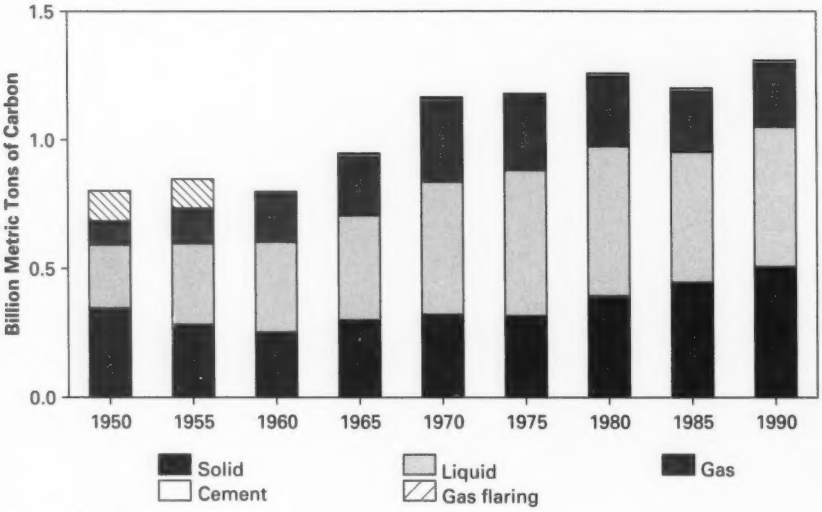
Source: See Table 40.

Figure 16f.—National ambient concentrations of lead, 1975-1991.



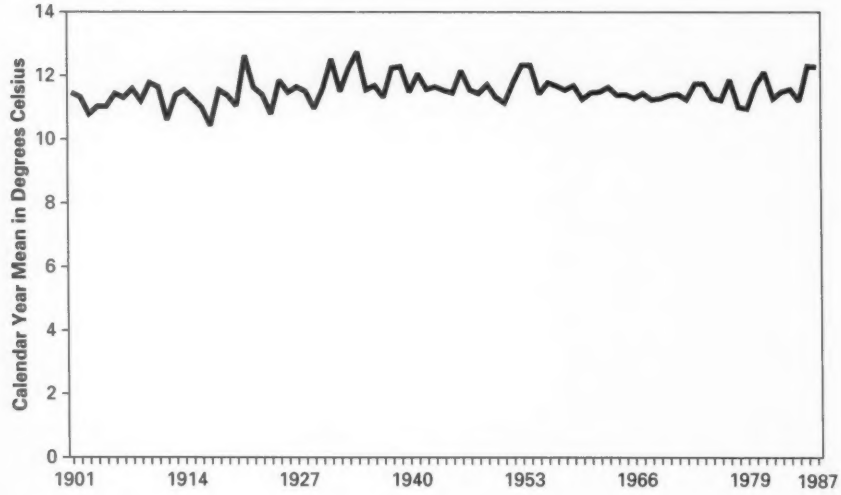
Source: See Table 40.

Figure 17.—U.S. emissions of carbon dioxide from anthropogenic sources, 1950-1990.



Source: See Table 38.

Figure 18.—U.S. average air temperature, 1901-1987.



Source: See Table 44.

Table 37.—U.S. emissions of six major air pollutants, by source, 1970-1991.

Year	Sulfur oxides					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1970	0.61	21.29	6.43	0.00	0.10	28.42
1975	0.64	20.23	4.57	0.04	0.02	25.51
1980	0.90	19.10	3.74	0.03	0.01	23.78
1981	0.89	17.78	3.80	0.03	0.01	22.51
1982	0.83	17.27	3.08	0.03	0.01	21.21
1983	0.79	16.69	3.11	0.02	0.01	20.62
1984	0.82	17.41	3.20	0.02	0.01	21.47
1985	0.88	17.58	3.17	0.02	0.01	21.67
1986	0.87	17.09	3.16	0.02	0.01	21.15
1987	0.89	17.04	3.01	0.02	0.01	20.97
1988	0.94	17.25	3.08	0.02	0.01	21.30
1989	0.96	17.42	3.10	0.02	0.01	21.51
1990	0.99	16.98	3.05	0.02	0.01	21.05
1991	0.99	16.55	3.16	0.02	0.01	20.73

Year	Nitrogen oxides					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1970	8.45	9.11	0.70	0.40	0.3	18.96
1975	10.02	9.33	0.68	0.14	0.15	20.33
1980	12.46	10.10	0.68	0.10	0.23	23.56
1981	10.42	10.01	0.64	0.10	0.19	21.35
1982	9.74	9.84	0.55	0.09	0.15	20.37
1983	9.35	9.60	0.55	0.08	0.23	19.80
1984	9.10	10.16	0.58	0.08	0.19	20.11
1985	9.15	9.38	0.56	0.08	0.21	19.39
1986	8.49	9.55	0.56	0.08	0.16	18.83
1987	8.14	10.05	0.56	0.08	0.19	19.03
1988	8.19	10.52	0.58	0.08	0.28	19.65
1989	7.85	10.59	0.59	0.08	0.19	19.29
1990	7.83	10.63	0.59	0.08	0.26	19.38
1991	7.26	10.59	0.60	0.01	0.21	18.76

continued

Table 37 (continued).—U.S. emissions of six major air pollutants, by source, 1970-1991.

Year	Reactive volatile organic compounds					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1970	12.76	0.61	8.93	1.80	3.30	27.40
1975	10.32	0.60	8.19	0.88	2.54	22.53
1980	8.10	0.95	9.13	0.67	2.90	21.75
1981	8.94	0.95	8.24	0.65	2.44	21.22
1982	8.32	1.01	7.41	0.63	2.13	19.50
1983	8.19	1.00	7.80	0.60	2.65	20.26
1984	8.07	1.01	8.68	0.60	2.64	20.99
1985	7.47	0.90	8.35	0.60	2.49	19.80
1986	6.88	0.89	7.92	0.58	2.19	18.45
1987	6.59	0.90	8.17	0.58	2.40	18.64
1988	6.26	0.89	8.00	0.58	2.88	18.61
1989	5.45	0.91	7.97	0.58	2.44	17.35
1990	5.54	0.62	8.02	0.58	2.82	17.58
1991	5.08	0.67	7.86	0.69	2.59	16.88

Year	Carbon monoxide					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1970	96.85	4.21	8.95	6.40	7.20	123.61
1975	86.15	4.03	6.88	2.93	4.77	104.76
1980	77.38	6.59	6.34	2.09	7.57	99.97
1981	77.08	6.65	5.87	2.01	6.43	98.04
1982	72.26	7.07	4.35	1.94	4.91	90.53
1983	71.40	6.97	4.34	1.84	7.76	92.31
1984	67.68	7.05	4.66	1.84	6.36	87.60
1985	63.52	6.29	4.38	1.85	7.09	83.12
1986	58.71	6.27	4.20	1.70	5.15	76.03
1987	56.24	6.34	4.33	1.70	6.44	75.05
1988	53.45	6.27	4.60	1.70	9.51	75.53
1989	49.30	6.40	4.58	1.70	6.34	68.32
1990	48.48	4.30	4.64	1.70	8.62	67.74
1991	43.49	4.68	4.69	2.06	7.18	62.10

continued

Table 37 (continued).—U.S. emissions of six major air pollutants, by source, 1970-1991.

Year	National total suspended particulates					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1970	1.18	5.07	10.54	1.10	1.10	18.99
1975	1.30	3.28	5.19	0.44	0.75	10.96
1980	1.31	3.04	3.31	0.33	1.08	9.06
1981	1.33	2.96	3.03	0.32	0.94	8.58
1982	1.30	2.75	2.57	0.31	0.75	7.67
1983	1.28	2.72	2.39	0.29	1.09	7.77
1984	1.31	2.76	2.80	0.29	0.93	8.08
1985	1.38	2.47	2.70	0.29	1.01	7.85
1986	1.36	2.46	2.43	0.28	0.78	7.31
1987	1.39	2.44	2.38	0.28	0.93	7.42
1988	1.48	2.40	2.48	0.28	1.30	7.94
1989	1.52	2.41	2.46	0.27	0.92	7.57
1990	1.54	1.87	2.53	0.28	1.19	7.40
1991	1.57	1.94	2.55	0.34	1.01	7.41

Year	National PM-10 particulates					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	million metric tons					
1985	1.32	1.46	1.90	0.21	0.73	5.61
1986	1.31	1.48	1.74	0.20	0.54	5.27
1987	1.35	1.49	1.70	0.20	0.66	5.40
1988	1.43	1.45	1.73	0.20	0.96	5.76
1989	1.47	1.49	1.77	0.20	0.65	5.59
1990	1.48	1.04	1.81	0.20	0.87	5.42
1991	1.51	1.10	1.84	0.26	0.73	5.45

Year	National PM-10 fugitive particulates					
	Agricultural tilling	Construction	Mining & quarrying	Paved roads	Unpaved roads	Wind erosion
	million metric tons					
1985	6.20	11.49	0.31	5.95	13.34	3.23
1986	6.26	10.73	0.28	6.18	13.30	8.52
1987	6.36	11.00	0.34	6.47	12.65	1.32
1988	6.43	10.58	0.31	6.91	14.17	15.88
1989	6.29	10.22	0.35	6.72	13.91	10.73
1990	6.35	9.11	0.34	6.83	14.20	3.80
1991	6.32	8.77	0.36	7.39	14.36	9.19

continued

Table 37 (continued).—U.S. emissions of six major air pollutants, by source, 1970-1991.

Year	Lead					
	Transportation	Fuel combustion	Industrial processes	Solid waste	Miscellaneous	Total
	thousand metric tons					
1970	163.60	9.60	23.86	2.00	0.00	199.06
1975	122.67	9.39	10.32	1.45	0.00	143.83
1980	59.43	3.90	3.57	1.10	0.00	68.00
1981	46.46	2.81	3.05	1.10	0.00	53.42
1982	46.96	1.70	2.71	0.94	0.00	52.31
1983	40.80	0.60	2.44	0.82	0.00	44.66
1984	34.69	0.49	2.30	0.82	0.00	38.30
1985	14.70	0.47	2.30	0.79	0.00	18.26
1986	3.450	0.47	1.93	0.77	0.00	6.62
1987	3.03	0.46	1.94	0.77	0.00	6.21
1988	2.64	0.46	2.02	0.74	0.00	5.86
1989	2.15	0.46	2.23	0.69	0.00	5.53
1990	1.71	0.46	2.23	0.73	0.00	5.13
1991	1.62	0.45	2.21	0.69	0.00	4.97

Source: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, National Air Quality and Emissions Trends Report, 1991, EPA-450-R-92-001, (Research Triangle Park, NC: EPA, October 1992).

Notes: Estimates of emissions from transportation sources have been recalculated using a revised model. These estimates supersede those reported in last year's report and are not directly comparable to historical estimates calculated using different models. PM-10 refers to particulates with aerodynamic diameter smaller than 10 micrometers. These smaller particles are likely responsible for most adverse health effects of particulates because of their ability to reach the thoracic or lower regions of the respiratory tract. Detail may not agree with totals because of independent rounding.

Related Tables: 15, 22, 38, 40, 42, 43, 50, 52, 61, 88-91, 94, 96.

Table 38.—U.S. emissions of carbon dioxide, from anthropogenic sources, 1950-1990.

Year	Solid	Liquid	Gas	Cement	Gas flaring	Total	Per capita
	million metric tons of carbon						*metric tons*
1950	347.1	244.8	87.1	5.3	11.8	696.1	4.57
1951	334.5	262.2	102.7	5.7	11.7	716.7	4.63
1952	296.6	273.2	109.9	5.8	12.5	697.9	4.44
1953	294.3	286.6	115.5	6.1	11.9	714.5	4.46
1954	252.2	290.2	121.2	6.3	10.6	680.5	4.18
1955	283.3	313.3	130.8	7.2	11.4	746.0	4.50
1956	295.0	328.5	138.1	7.6	12.7	781.9	4.63
1957	282.7	325.8	147.6	7.1	1.9	775.1	4.51
1958	245.3	333.0	155.8	7.5	9.3	750.8	4.29
1959	251.5	343.5	169.9	8.1	8.4	781.4	4.40
1960	253.4	349.8	180.4	7.6	8.3	799.5	4.43
1961	245.0	354.1	187.4	7.7	7.7	801.9	4.37
1962	254.2	364.3	198.7	8.0	6.3	831.5	4.46
1963	272.5	378.8	210.3	8.4	5.6	875.6	4.63
1964	289.7	389.7	219.8	8.8	5.0	912.9	4.76
1965	301.1	405.6	228.0	8.9	4.7	948.3	4.88
1966	312.7	425.9	246.4	9.1	5.5	990.7	0.08
1967	321.1	443.6	258.5	8.8	7.2	1,039.2	5.23
1968	314.8	471.9	277.4	9.4	7.6	1,081.0	5.38
1969	319.7	497.4	297.8	9.5	7.7	1,132.0	5.58
1970	322.4	514.8	312.1	9.0	7.2	1,165.5	5.68
1971	305.7	530.5	323.3	9.7	4.2	1,173.2	5.66
1972	310.4	575.5	327.6	10.2	3.6	1,227.3	5.86
1973	334.0	605.4	321.7	10.6	3.6	1,275.4	6.03
1974	330.1	580.7	307.9	10.0	2.4	1,231.1	5.76
1975	317.6	565.1	286.0	8.4	1.9	1,179.0	5.46
1976	351.6	608.1	291.3	9.0	2.0	1,262.0	5.78
1977	355.6	641.9	260.5	9.7	2.0	1,269.7	5.76
1978	361.2	655.0	264.7	10.4	2.2	1,293.4	5.80
1979	378.7	634.6	274.8	10.4	2.4	1,300.9	5.77
1980	394.6	581.0	272.5	9.3	1.8	1,259.3	5.53
1981	403.0	533.1	264.2	8.8	1.4	1,210.6	5.26
1982	390.1	502.2	245.4	7.8	1.4	1,146.9	4.93
1983	405.5	500.1	233.8	8.7	1.4	1,149.4	4.89
1984	427.8	507.1	241.5	9.6	1.6	1,187.5	5.01
1985	448.0	505.6	236.7	9.6	1.4	1,201.3	5.02
1986	439.7	531.1	222.6	9.7	1.4	1,204.5	4.99
1987	463.3	545.3	233.8	9.6	1.8	1,253.8	5.15
1988	491.4	566.3	244.6	9.5	2.1	1,313.8	5.35
1989	498.4	566.5	252.4	9.5	2.1	1,328.9	5.37
1990	508.1	542.9	247.9	9.5	1.9	1,310.3	5.26

Source: Marland, G. & T. Boden, NDP030/R4, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, (Oak Ridge, TN: DOE, 1992).

Related Tables: 17-19, 22, 36, 44, 88, 89.

Table 39.—Concentration of cations and anions in precipitation in the eastern and western United States, 1985-1991.

Year	Eastern United States					
	Hydrogen ion	Sulfate ion	Nitrate ion	Ammonium ion	Calcium ion	Precipitation
	milligrams per liter					*cm*
1985	37.60	2.05	1.25	0.23	0.15	107.3
1986	37.79	2.13	1.30	0.23	0.13	102.9
1987	38.00	2.09	1.32	0.26	0.14	101.1
1988	36.76	2.14	1.32	0.21	0.17	96.4
1989	34.06	2.00	1.34	0.31	0.15	110.5
1990	32.53	1.73	1.17	0.27	0.12	123.2
1991	33.73	1.87	1.27	0.26	0.14	111.0

Year	Western United States					
	Hydrogen ion	Sulfate ion	Nitrate ion	Ammonium ion	Calcium ion	Precipitation
	milligrams per liter					*cm*
1985	7.76	0.85	0.71	0.18	0.23	61.7
1986	7.01	0.80	0.69	0.17	0.19	71.4
1987	8.18	0.86	0.83	0.23	0.19	61.7
1988	8.14	0.94	0.83	0.16	0.27	55.5
1989	5.74	0.89	0.92	0.29	0.26	55.8
1990	6.35	0.82	0.87	0.29	0.22	66.7
1991	6.49	0.78	0.82	0.24	0.21	67.4

Source: Data are from the National Trends Network of the National Atmospheric Deposition Program (NADP/NTN), 1992.

Notes: Data are compiled from 78 sites in the eastern United States and 43 sites in the western United States. Sites included in the computations are those which met the following criteria for all seven annual summary periods: (1) precipitation amounts available for at least 90% of the summary period; and (2) at least 60% of the precipitation during the summary period represented by valid samples.

Related Tables: 22, 25, 27, 28, 37, 52, 88, 89.

Table 40.—National ambient concentrations of criteria air pollutants, 1975-1991.

Year	Sulfur dioxide	Carbon monoxide	Ozone	Nitrogen dioxide	Particulate (TSP)	Lead
		ppm			*ug/m3*	*ug/m3*
1975	0.0154	11.96	0.153	0.029	61.9	1.04
1976	0.0156	11.32	0.153	0.029	62.8	1.05
1977	0.0138	10.66	0.155	0.029	62.9	1.16
1978	0.0126	10.07	0.156	0.029	62.4	1.04
1979	0.0120	9.07	0.134	0.026	63.1	0.77
1980	0.0109	8.52	0.136	0.025	64.2	0.61
1981	0.0104	8.29	0.127	0.024	57.4	0.48
1982	0.0096	7.95	0.125	0.024	48.7	0.48
1983	0.0092	7.82	0.137	0.023	48.4	0.41
1984	0.0094	7.74	0.124	0.024	49.9	0.38
1985	0.0088	6.99	0.123	0.024	47.7	0.26
1986	0.0085	7.11	0.118	0.024	47.6	0.15
1987	0.0090	6.67	0.125	0.024	48.6	0.11
1988	0.0090	6.42	0.136	0.024	49.7	0.09
1989	0.0090	6.32	0.116	0.023	48.0	0.07
1990	0.0080	5.89	0.114	0.022	47.3	0.07
1991	0.0077	5.60	0.115	0.022	47.3	0.06

Source: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, National Air Quality and Emissions Trends Report, 1991, and earlier reports in this series, EPA-450-R-92-001, (Research Triangle Park, NC: EPA, October 1992).

Notes: ppm=parts per million. ug/m3=micrograms per cubic meter. TSP=total suspended particulates. Sulfur dioxide and nitrogen dioxide records are arithmetic means. Carbon monoxide and ozone records are second maximum readings over 8- and 24-hour periods, respectively. TSP records are geometric means. Lead records are maximum quarterly recordings. Data represent composite averages from all sites in the nationwide monitoring network.

Related Tables: 9, 10, 37, 38, 41-43.

Table 41.—Concentrations of carbon dioxide above U.S. monitoring stations, 1973-1991.

Year	Mauna Loa, Hawaii	South Pole	American Samoa	Point Barrow, Alaska
	parts per million by volume			
1973	329.5	327.4	na	na
1974	330.1	328.3	na	na
1975	331.0	329.4	na	333.2
1976	332.0	330.5	na	334.0
1977	333.7	331.9	na	na
1978	335.3	na	na	na
1979	336.7	334.8	na	na
1980	338.5	na	na	na
1981	339.8	338.1	na	340.9
1982	341.0	na	340.4	342.4
1983	342.6	341.0	341.8	343.7
1984	344.3	na	343.7	345.5
1985	345.7	343.6	na	346.7
1986	347.0	345.2	na	348.5
1987	348.8	346.9	347.9	349.8
1988	351.4	348.8	350.0	353.0
1989	352.8	350.3	351.5	355.0
1990	354.0	351.5	352.7	355.5
1991	355.2	352.8	354.0	357.1

Source: Keeling, C.D., Scripps Institution of Oceanography, La Jolla, CA.

Note: na=not available. Annual mean concentration is reported only when all 12 monthly average concentrations are available.

Related Tables: 15, 22, 38, 44, 58.

Table 42.—Air quality trends in major urban areas, 1980-1991.

PMSA	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
	number of PSI days greater than 100											
Atlanta	7	9	5	23	8	9	17	19	15	3	16	5
Boston	8	2	5	16	6	2	0	5	11	1	1	5
Chicago	na	3	31	14	8	4	5	9	18	2	3	8
Dallas	10	12	11	17	10	12	5	6	3	3	5	0
Denver	35	51	52	67	59	37	43	34	18	11	7	7
Detroit	na	18	19	18	7	2	6	9	17	12	3	7
Houston	10	32	25	43	30	30	28	31	31	19	35	39
Kansas City	13	7	0	4	12	4	8	5	3	2	2	1
Los Angeles	220	228	195	184	208	196	210	187	226	212	163	156
New York	119	100	69	65	53	21	16	16	35	9	10	16
Philadelphia	52	29	44	56	31	25	21	36	34	19	11	24
Pittsburgh	20	17	14	36	24	6	9	15	31	11	12	3
San Francisco	2	1	2	4	2	5	4	1	1	0	1	0
Seattle	33	42	19	19	4	26	18	13	8	4	2	0
Washington	38	23	25	53	30	15	11	23	34	7	5	16
Total	567	576	488	619	492	396	400	409	484	315	276	285

Source: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, National Air Quality and Emissions Trends Report, 1990, EPA-450/4-91-023, (Research Triangle Park, NC: EPA, October 1992).

Notes: PMSA=Primary Metropolitan Statistical Area. PSI=Pollutant Standards Index. The PSI index integrates information from many pollutants across an entire monitoring network into a single number which represents the worst daily air quality experienced in the urban area. Only carbon monoxide and ozone monitoring sites with adequate historical data are included in the PSI trend analysis above, except for Pittsburgh, where sulfur dioxide contributed a significant number of days in the PSI high range. PSI index ranges and health effect descriptor words are as follows: 0 to 50 (good); 51 to 100 (moderate); 101 to 199 (unhealthful; 200 to 299 (very unhealthful); and 300 and above (hazardous). The table above shows the number of days when the PSI was greater than 100 (=unhealthy or worse days).

Related Tables: 37, 40, 43.

Table 43.—Persons living in counties with air quality levels above National Ambient Air Quality Standards, 1984-1991.

Pollutant	1984	1985	1986	1987	1988	1989	1990	1991
	millions of persons							
Sulfur dioxide	1.7	2.2	0.9	1.6	1.7	0.1	1.4	5.2
Nitrogen oxide	7.5	7.5	7.5	7.5	8.3	8.5	8.5	8.9
Carbon monoxide	61.3	39.6	41.4	29.4	29.5	33.6	21.7	19.9
Ozone	79.2	76.4	75.0	88.6	111.9	66.7	62.9	69.7
Lead	4.7	4.5	4.5	1.7	1.6	1.6	5.3	14.7
Particulates	32.6	47.8	41.7	21.5	25.6	27.4	18.8	21.5

Source: U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, National Air Quality and Emissions Trends Report, 1991, and earlier reports in this series, EPA-450-R-92-001, (Research Triangle Park, NC: EPA, October 1992).

Notes: Particulates for 1984-1986 refer to total suspended particulates. After 1986, particulates refer to PM-10 (particulates less than 10 micrometers in diameter).

Related Tables: 37, 40, 42.

Table 44.—U.S. average air temperature, 1901-1987.

Year	Calendar year mean	Seasonal year mean	Year	Calendar year mean	Seasonal year mean	Year	Calendar year mean	Seasonal year mean
	degrees Celsius			*degrees Celsius*			*degrees Celsius*	
1901	11.46	11.61	1930	11.59	11.72	1959	11.69	11.51
1902	11.33	11.35	1931	12.52	12.32	1960	11.26	11.51
1903	10.79	10.82	1932	11.51	11.78	1961	11.47	11.43
1904	11.03	10.95	1933	12.24	11.93	1962	11.49	11.40
1905	11.03	11.06	1934	12.75	12.93	1963	11.64	11.91
1906	11.44	11.27	1935	11.56	11.65	1964	11.39	11.15
1907	11.31	11.33	1936	11.69	11.51	1965	11.41	11.25
1908	11.59	11.65	1937	11.32	11.42	1966	11.29	11.44
1909	11.21	11.57	1938	12.25	12.18	1967	11.45	11.45
1910	11.78	11.50	1939	12.29	12.13	1968	11.24	11.36
1911	11.65	11.63	1940	11.49	11.56	1969	11.28	11.14
1912	10.61	10.57	1941	12.06	12.04	1970	11.38	11.36
1913	11.39	11.37	1942	11.57	11.73	1971	11.42	11.39
1914	11.55	11.85	1943	11.65	11.68	1972	11.25	11.45
1915	11.27	10.98	1944	11.54	11.62	1973	11.75	11.60
1916	11.01	11.19	1945	11.46	11.53	1974	11.75	11.72
1917	10.43	10.42	1946	12.16	11.83	1975	11.29	11.27
1918	11.55	11.30	1947	11.55	11.72	1976	11.23	11.38
1919	11.38	11.66	1948	11.44	11.43	1977	11.88	11.76
1920	11.05	10.86	1949	11.72	11.71	1978	11.02	11.16
1921	12.63	12.52	1950	11.32	11.38	1979	10.96	10.69
1922	11.64	11.71	1951	11.14	11.19	1980	11.71	11.75
1923	11.41	11.28	1952	11.78	11.70	1981	12.12	12.20
1924	10.80	11.21	1953	12.33	12.32	1982	11.28	11.16
1925	11.86	11.66	1954	12.33	12.32	1983	11.50	11.98
1926	11.48	11.52	1955	11.43	11.53	1984	11.57	11.14
1927	11.65	11.77	1956	11.78	11.56	1985	11.21	11.53
1928	11.51	11.31	1957	11.68	11.62	1986	12.30	12.03
1929	10.97	10.92	1958	11.55	11.77	1987	12.28	12.27

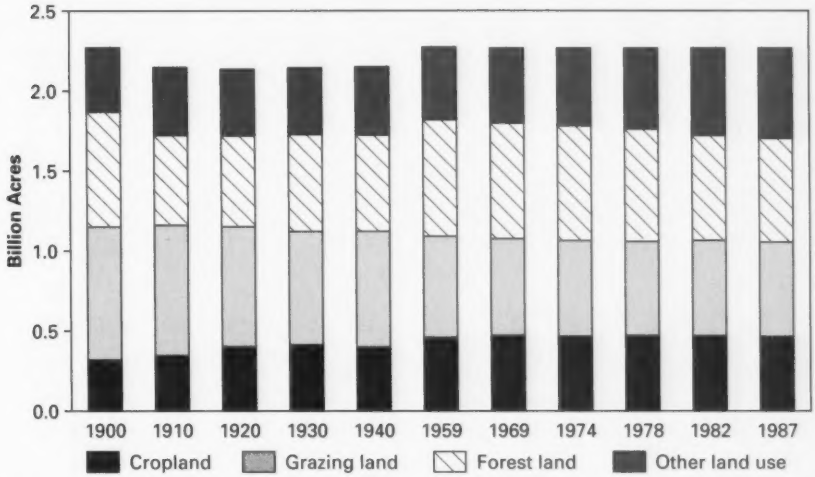
Source: Karl, T.R., C.N. Williams & F.T. Quinlan. United States historical climatology (HCN) serial temperature and precipitation data, NDP-019/R1, Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, (Oak Ridge, TN: DOE, 1990).

Note: Calendar year mean (January-December). Seasonal year mean, calculated from four seasons in the following sequence: Winter (December-February); Spring (March-May); Summer (June-August); and Fall (September-November). For seasonal means, see Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Trends '91: A Compendium of Data on Global Change, p. 573, (Oak Ridge, TN: DOE, 1991).

Related Tables: 27, 28, 38.

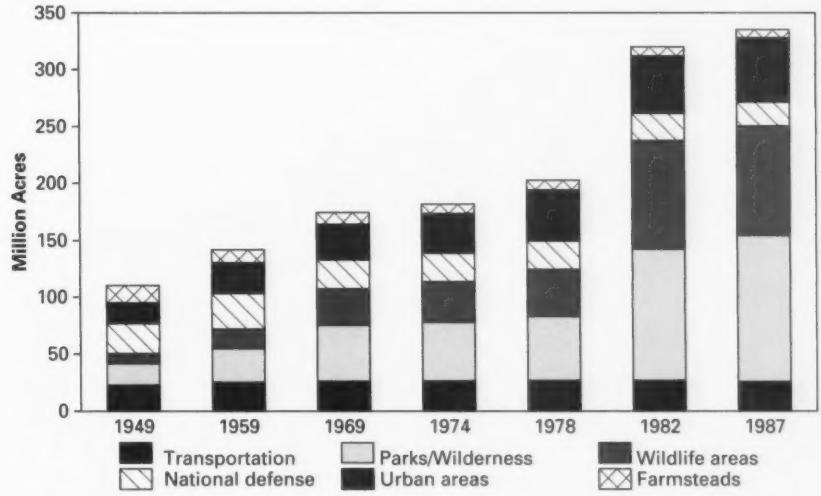
Land, Agriculture, and Forestry

Figure 19.—Land use in the United States, 1900-1987.



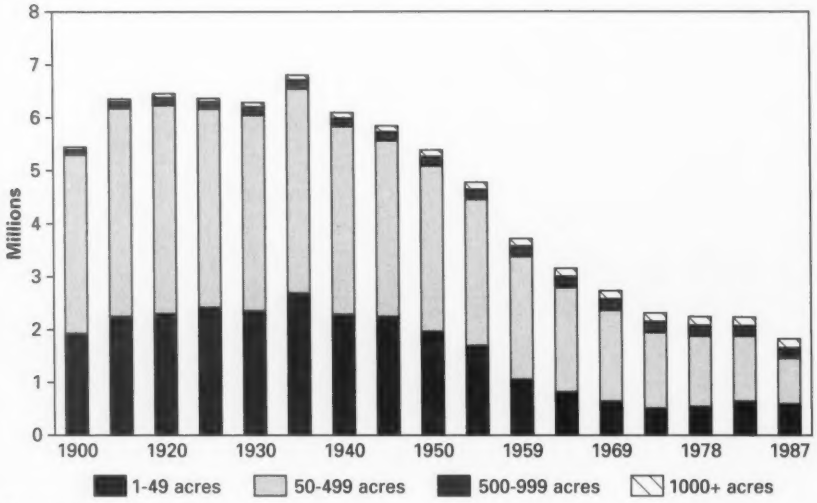
Source: See Table 45.

Figure 20.—Special uses of land, 1949-1987.



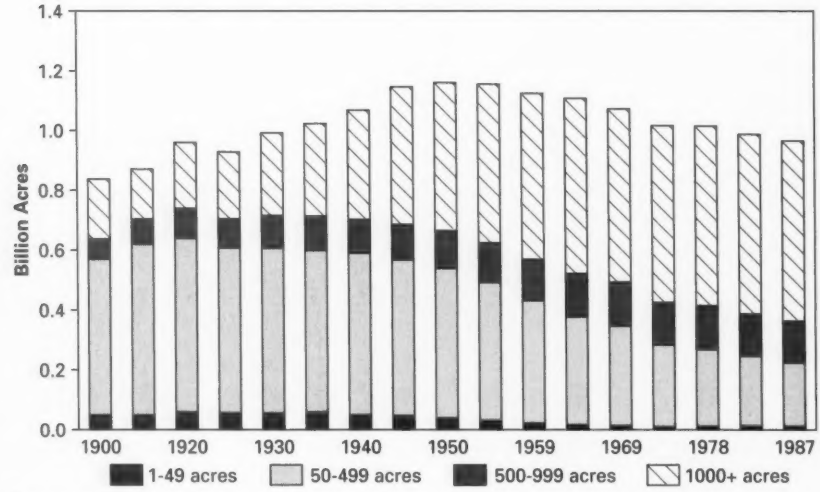
Source: See Table 46.

Figure 21a.—Number of farms in the United States, by farm size, 1900-1987.



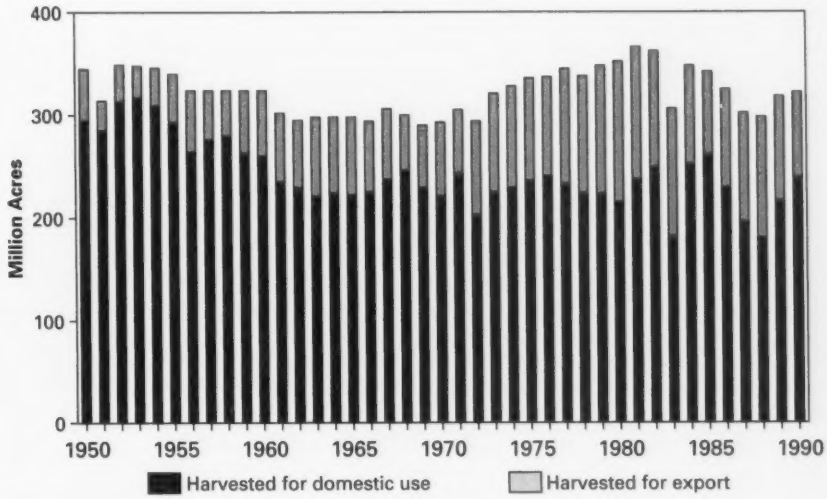
Source: See Table 47.

Figure 21b.—Land in farms in the United States, by farm size, 1900-1987.



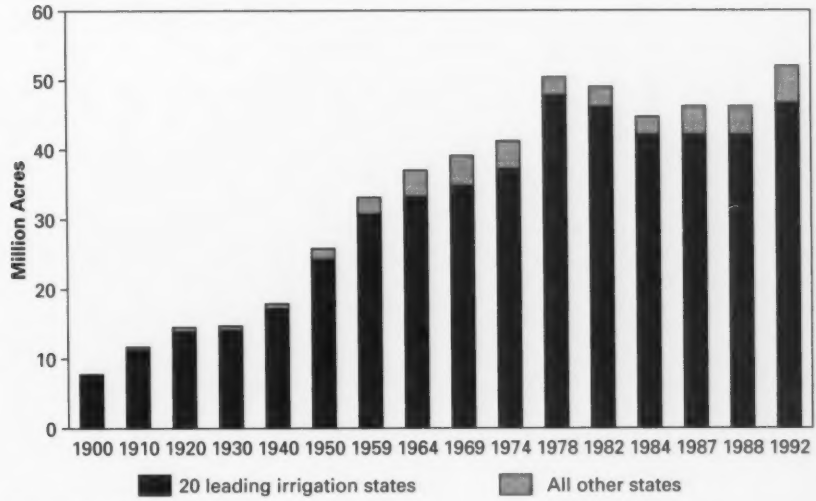
Source: See Table 47.

Figure 22. —Cropland acreages harvested for export and domestic uses, 1950-1990.



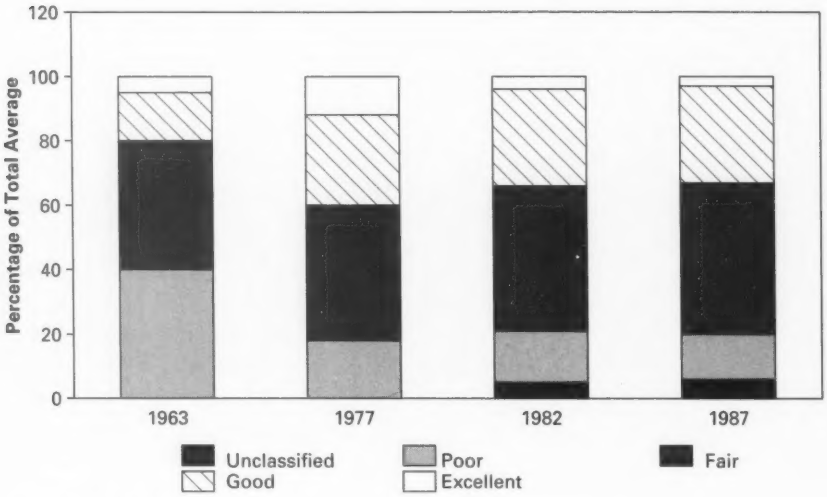
Source: See Table 49.

Figure 23.—Irrigated farmland, 1900-1992.



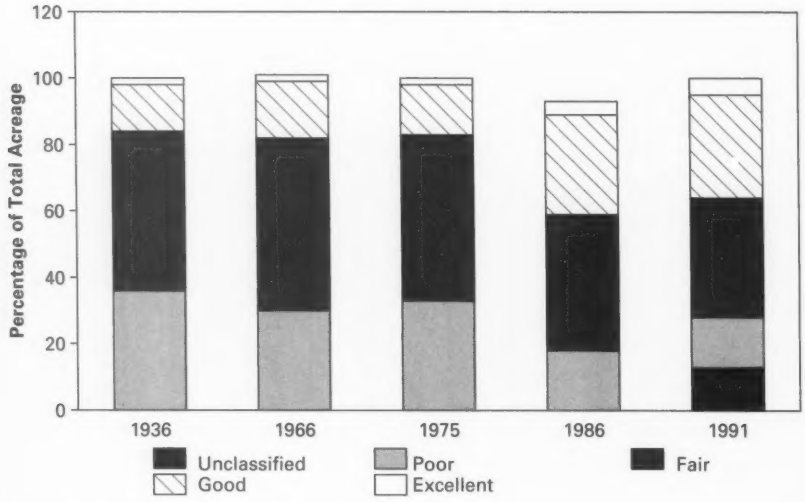
Source: See Table 55.

Figure 24a.—Condition of nonfederal rangeland, 1963-1987.



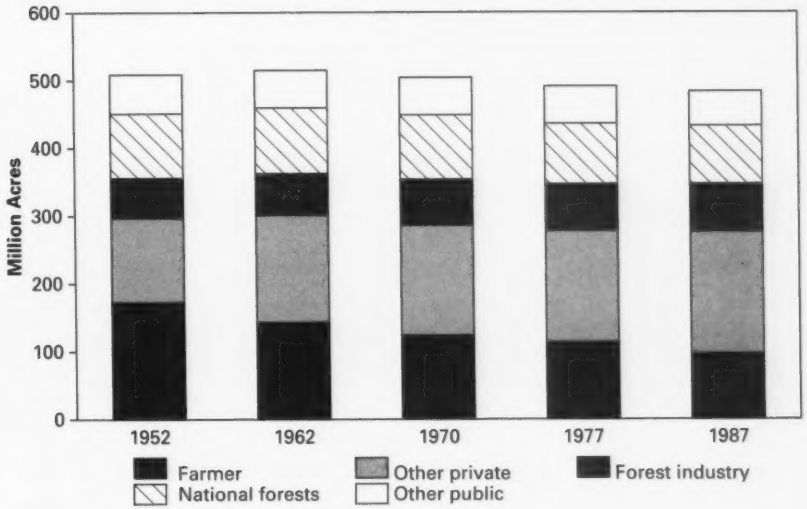
Source: See Table 56.

Figure 24b.—Condition of Bureau of Land Management rangeland, 1936-1991.



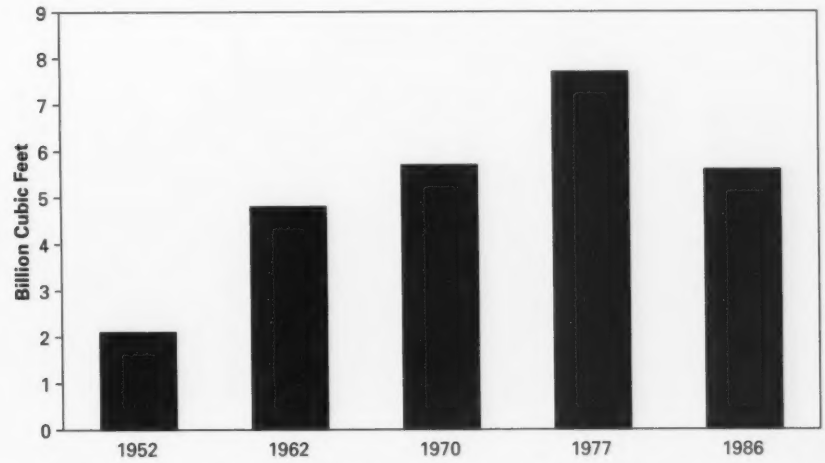
Source: See Table 56.

Figure 25.—Timberland in the United States, by ownership, 1952-1987.



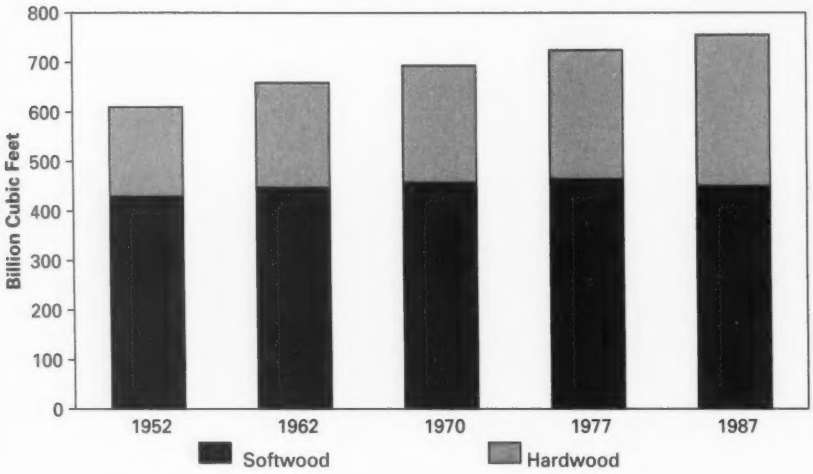
Source: See Table 57.

Figure 26.—Net growth of U.S. timber stocks, 1952-1986.



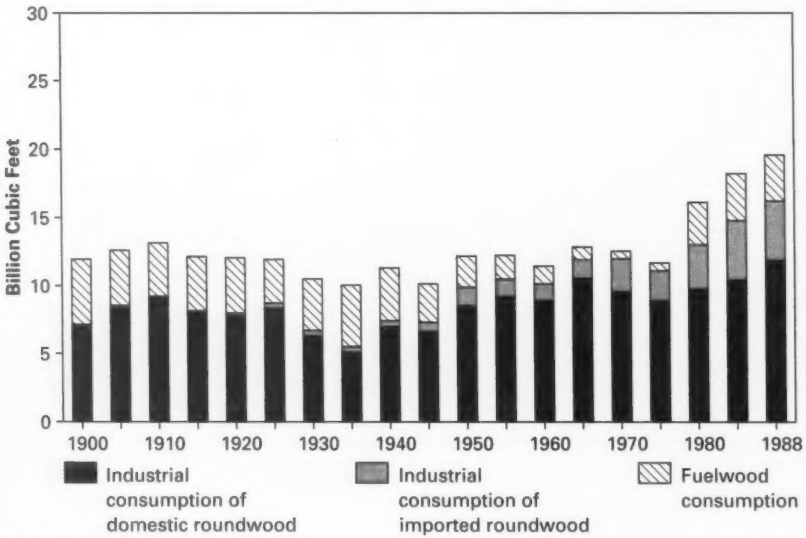
Note: Net growth=annual growth minus annual removal of growing stocks.
Source: See Table 58.

Figure 27.—Volume of timber stocks in the United States, 1952-1987.



Source: See Table 58.

Figure 28.—Roundwood consumption in the United States, 1900-1988.



Source: See Table 60.

Table 45.—Land use and ownership in the United States, 1900-1987.

	Land use						Ownership	
Year	Crop-land	Grazing land	Forest-land	Special use	Other land	Total	Private land	Public domain
	million acres						%	
1900	319	832	719	na	400	1,904	52.7	47.3
1910	347	814	562	na	424	1,904	68.5	31.5
1920	402	750	567	86	330	1,904	73.8	26.2
1930	413	708	607	na	416	1,904	74.0	26.0
1940	399	723	602	99	327	1,904	73.7	26.3
1959	458	633	728	123	329	2,271	66.2	33.8
1969	472	604	723	141	324	2,264	66.5	33.5
1974	465	598	718	147	336	2,264	66.5	33.5
1978	471	587	703	158	345	2,264	67.2	32.9
1982	469	597	655	270	274	2,265	67.9	32.2
1987	464	591	648	279	283	2,265	68.1	31.9

Source: Daugherty, A.B., Major Uses of Land in the United States: 1987, AER 535 and earlier reports in this series, (Washington, DC: DOA, Economic Research Service, 1991). U.S. Department of Commerce, Bureau of the Census. Statistical Abstract of the United States, (Washington, DC: DOC, annual).

Notes: The total land area of the United States increased in 1959 with the addition of Alaska and Hawaii as states. Other changes in total land area result from refinements in measuring techniques. Public land includes original public-domain lands vested in the U.S. Government by virtue of its sovereignty as well as lands acquired by the U.S. Government by purchase, condemnation, and gift. Historical estimates are based on imperfect data. Special-use land includes rural transportation areas, areas used primarily for recreation and wildlife purposes, various public installations and facilities, farmsteads and farm roads. Other includes urban areas, areas in miscellaneous uses not inventoried, and marshes, open swamps, bare rock areas, desert, tundra, and other land generally having low value for agricultural purposes. Land-use and land-ownership estimates are not strictly comparable.

Related Tables: 4, 6, 15, 46-50, 55, 56-58, 61, 63-73.

Table 46.—Special uses of land in the United States, 1949-1987.

Land use	1949	1959	1969	1974	1978	1982	1987
	million acres						
Transportation	22.9	25.2	26.0	26.3	26.6	26.7	25.7
Parks and wilderness	18.8	29.7	49.3	51.6	56.6	115.8	128.5
Wildlife areas	8.9	17.2	32.1	35.8	41.4	95.2	96.4
National defense	26.3	31.1	25.6	25.0	24.9	24.0	20.9
Urban	18.3	27.2	31.0	34.8	44.6	50.2	56.6
Farmsteads & farm roads	15.1	11.4	10.3	8.1	8.4	8.0	7.1
Total	118.4	141.8	174.3	181.6	202.5	319.9	335.2

Source: Daugherty, A.B., Major Uses of Land in the United States: 1987, AER 535 and earlier reports in this series, (Washington, DC: DOA, ERS, 1991).

Note: Categories of special-use lands correspond to those listed as special in Table 45, except urban is listed as "other land" in Table 45.

Related Tables: 4, 6, 15, 45, 47-50, 55, 56-58, 61, 63-73.

Table 47.—Number of farms and land in farms, 1900-1987.

	Farm size category by acre								Total farms	
	1 - 49		50 - 499		500 - 999		1,000 +			
Year	Units	Area	Units	Area	Units	Area	Units	Area	Units	Area
	millions	*million acres*	*millions*	*million acres*	*millions*	*million acres*	*millions*	*million acres*	*millions*	*billion acres*
1900	1.93	49	3.37	520	0.10	68	0.05	200	5.74	0.84
1910	2.25	49	3.93	570	0.13	84	0.05	167	6.37	0.88
1920	2.31	59	3.93	580	0.15	100	0.07	221	6.45	0.96
1925	2.42	57	3.75	550	0.14	97	0.06	224	6.37	na
1930	2.36	56	3.69	550	0.16	109	0.08	277	6.30	0.99
1935	2.69	59	3.86	540	0.17	114	0.09	310	6.81	na
1940	2.29	50	3.55	540	0.16	112	0.10	366	6.10	1.07
1945	2.25	47	3.32	520	0.17	119	0.11	460	5.86	1.14
1950	1.97	39	3.12	500	0.18	126	0.12	495	5.39	1.16
1954	1.70	32	2.76	460	0.19	132	0.13	531	4.78	1.16
1959	1.06	22	2.32	410	0.20	137	0.14	555	3.71	1.12
1964	0.82	17	1.98	360	0.21	145	0.15	585	3.16	1.11
1969	0.64	14	1.73	320	0.22	148	0.15	578	2.73	1.06
1974	0.51	11	1.44	273	0.21	142	0.16	590	2.31	1.02
1978	0.54	12	1.34	256	0.21	147	0.16	600	2.26	1.02
1982	0.64	13	1.24	233	0.20	141	0.16	600	2.24	0.99
1987	0.59	12	0.87	212	0.20	139	0.17	602	2.09	0.96

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, (Washington, DC: DOC, 1976).

U.S. Department of Commerce, Bureau of the Census. Census of Agriculture for 1987, and earlier reports in this series, (Washington, DC: DOC, 1988).

Related Tables: 4, 29, 31, 34, 45, 46, 48-55, 63, 64.

Table 48.—Major uses of cropland, 1945-1992.

Year	Cropland used for crops						Diverted from production
	Harvested	Failed	Summer fallow	Idle	Cropland pasture	Total	
	million acres						*million acres*
1945	353	10	40	na	47	454	na
1949	352	9	26	22	67	478	na
1954	339	13	28	19	66	465	na
1959	317	10	31	33	66	457	22.5
1964	292	6	37	52	57	444	55.0
1969	286	6	41	51	88	472	57.5
1974	322	8	31	21	83	465	2.7
1978	330	7	32	26	76	471	18.3
1982	347	5	31	21	65	469	11.1
1987	293	6	32	68	65	464	76.2
1992	312	8	23	na	na	na	54.0

Source: U.S. Department of Agriculture, Economic Research Service, Cropland, Water and Conservation Situation and Outlook Report, AR-27, (Washington, DC: DOA,September 1992).

Notes: Acres of idle cropland, cropland pasture, and total cropland are estimated only for years coinciding with Census of Agriculture years. Data are for the conterminous United States. Cropland diversions occurred under federal farm programs. Data for 1992 are preliminary.

Related Tables: 29, 45, 47, 49-55, 63, 64.

Table 49.—Cropland acreages harvested for export and domestic uses, 1950-1990.

Year	Total cropland harvested	Cropland used to produce			Crop acreage in exports
		Exports	Domestic use goods	Domestic use per capita	
	million acres			*acres*	*%*
1950	345	50	295	1.82	14.49
1951	344	29	285	1.73	8.43
1952	349	36	313	1.90	10.32
1953	348	31	317	1.90	8.91
1954	346	37	309	1.84	10.69
1955	340	47	293	1.72	13.82
1956	324	60	264	1.52	18.52
1957	324	48	276	1.57	14.81
1958	324	44	280	1.57	13.58
1959	324	61	263	1.45	18.83
1960	324	64	260	1.41	19.75
1961	302	67	235	1.26	22.19
1962	295	66	229	1.20	22.37
1963	298	77	221	1.15	25.84
1964	298	74	224	1.15	24.83
1965	298	76	222	1.14	25.50
1966	294	69	225	1.14	23.47
1967	306	69	237	1.19	22.55
1968	300	54	246	1.22	18.00
1969	290	61	229	1.13	21.03
1970	293	72	221	1.08	24.57
1971	305	62	243	1.17	20.33
1972	294	91	203	0.97	30.95
1973	321	96	225	1.06	29.91
1974	328	99	229	1.07	30.18
1975	336	100	236	1.09	29.76
1976	337	97	240	1.10	28.78
1977	345	112	233	1.06	32.46
1978	338	114	224	1.00	33.73
1979	348	125	223	0.99	35.92
1980	352	137	215	0.94	38.92
1981	366	129	237	1.03	35.25
1982	362	113	249	1.07	31.22
1983	306	124	182	0.77	40.52
1984	348	96	252	1.06	27.59
1985	342	81	261	1.09	23.68
1986	325	96	229	0.95	29.54
1987	302	106	196	0.81	35.10
1988	298	118	180	0.73	39.60
1989	318	103	216	0.86	32.39
1990	322	83	239	0.95	25.78

Source: U.S. Department of Agriculture, Economic Research Service, Economic Indicators of the Farm Sector: Production and Efficiency Statistics, ECIFS 10-3 (Washington, DC: DOA, May 1992).

Related Tables: 29, 45, 47, 48, 50-55, 63, 64.

Table 50.—Soil erosion on nonfederal agricultural lands, 1977-1987.

Year	Sheet and rill erosion			Wind erosion		
	Cultivated cropland	Uncultivated cropland	Total	Cultivated cropland	Uncultivated cropland	Total
	tons per acre per year		*billion tons per year*	*tons per acre per year*		*billion tons per year*
1977	5.07	3.37	1.90	5.96	1.91	0.89
1982	4.70	0.80	1.80	3.40	0.40	1.25
1987	4.10	0.90	1.58	3.60	0.70	1.37

Year	Sheet and rill erosion					
	Pasture		Range		Forest	
	tons per acre per year	*billion tons per year*	*tons per acre per year*	*billion tons per year*	*tons per acre per year*	*billion tons per year*
1977	2.59	0.35	2.83	1.15	1.18	0.43
1982	1.26	0.17	1.32	0.53	0.87	0.34
1987	1.28	0.17	1.28	0.49	0.79	0.31

Source: U.S. Department of Agriculture, Soil Conservation Service, National Resources Inventory, (Washington, DC: DOA, SCS, 1977, 1982, and 1987).

Notes: Data for 1977 are not strictly comparable to data for 1982 and 1987 because of different reporting methods. During the period 1982 to 1987, cropland acres with excessive and rill erosion decreased from 104 million to about 94 million acres, whereas cropland acres with excessive wind erosion damage increased from 72 million to 76 million acres.

Related Tables: 29, 31, 45, 47-49, 55, 56.

Table 51.—Agricultural productivity indexes, 1950-1990.

Year	Farm inputs				Farm outputs			Total productivity
	Labor	Mechanical	Chemical	Total	Crops	Livestock	Total	
	Index (1977=100)							
1950	265	72	19	106	59	70	61	58
1951	251	77	21	106	60	73	63	60
1952	237	81	23	105	62	74	66	62
1953	220	82	24	103	62	74	66	64
1954	214	82	24	102	61	77	66	65
1955	220	83	29	104	63	79	69	66
1956	212	84	27	103	63	79	69	67
1957	188	83	27	100	62	78	67	67
1958	182	83	28	98	69	79	73	74
1959	183	84	32	101	68	83	74	73
1960	177	83	32	99	72	82	76	72
1961	167	80	35	98	70	86	76	78
1962	163	80	38	98	71	86	77	76
1963	155	79	43	98	74	89	80	82
1964	146	80	46	96	72	91	79	81
1965	144	80	49	97	76	89	82	84
1966	132	83	56	99	73	91	79	83
1967	128	85	66	98	77	94	83	86
1968	124	86	69	97	79	94	85	87
1969	118	86	73	96	80	95	85	88
1970	113	85	75	96	77	99	84	87
1971	108	87	81	97	86	100	92	93
1972	110	89	86	97	87	101	91	94
1973	109	90	90	98	92	99	93	95
1974	109	92	93	98	84	100	88	90
1975	106	96	83	97	93	95	95	99
1976	100	98	96	98	92	99	97	98
1977	100	100	100	100	100	100	100	100
1978	100	104	107	102	102	101	104	101
1979	99	104	123	103	113	104	111	105
1980	99	101	123	103	101	108	104	101
1981	96	98	129	103	117	109	118	115
1982	93	92	118	99	117	107	116	117
1983	97	89	102	96	88	109	96	99
1984	92	86	120	96	111	107	112	117
1985	85	80	115	92	118	110	118	125
1986	80	77	109	89	109	110	111	134
1987	78	74	111	89	108	113	110	124
1988	75	74	112	87	92	116	102	116
1989	76	73	119	87	107	116	114	130
1990	80	71	122	88	114	118	119	135

Source: U.S. Department of Agriculture, Economic Research Service, Economic Indicators of the Farm Sector: Production and Efficiency Statistics, (Washington, DC: DOA, May 1992).

Notes: Inputs excludes farm real estate, feed, seed, and livestock purchases, taxes and interest, and miscellaneous. Livestock outputs=meat animals, dairy products, poultry and eggs, wool, mohair, honey & beeswax. Crop outputs=feed grains, hay and forage, vegetables, fruit, nuts, sugar crops, cotton, tobacco, oil crops & miscellaneous. Productivity=output/input.

Related Tables: 45-50, 52-55, 94.

Table 52.—Farm fuel use, 1974-1991.

Year	Gasoline	Diesel	Liquefied petroleum gas
		billion gallons	
1974	3.7	2.6	1.4
1975	4.5	2.4	1.0
1976	3.9	2.8	1.2
1977	3.8	2.9	1.1
1978	3.6	3.2	1.3
1979	3.4	3.2	1.1
1980	3.0	3.2	1.1
1981	2.7	3.1	1.0
1982	2.4	2.9	1.1
1983	2.3	3.0	0.9
1984	2.1	3.0	0.9
1985	1.9	2.9	0.9
1986	1.7	2.9	0.7
1987	1.5	3.0	0.6
1988	1.6	2.8	0.6
1989	1.6	3.2	0.6
1990	1.5	2.7	0.6
1991	1.4	2.8	0.6

Source: U.S. Department of Agriculture, Economic Research Service, Agricultural Resources: Inputs Outlook and Situation Report, AR-28, (Washington, DC: DOA, October 1992).

Related Tables: 17, 21, 22, 26, 47-51, 53-55.

Table 53.—Farm fertilizer use, 1940-1992.

Year	Quantity	Year	Quantity	Year	Quantity
	million tons		*million tons*		*million tons*
1940	1.8	1958	6.5	1976	20.8
1941	1.9	1959	7.4	1977	22.1
1942	2.1	1960	7.5	1978	20.6
1943	2.4	1961	7.8	1979	22.6
1944	2.6	1962	8.4	1980	23.1
1945	2.7	1963	9.5	1981	23.7
1946	3.1	1964	10.5	1982	21.4
1947	3.3	1965	11.0	1983	18.1
1948	3.6	1966	12.4	1984	21.8
1949	3.9	1967	14.0	1985	21.7
1950	4.1	1968	15.0	1986	19.7
1951	4.7	1969	15.5	1987	19.1
1952	5.2	1970	16.1	1988	19.6
1953	5.6	1971	17.2	1989	19.6
1954	5.9	1972	17.2	1990	20.6
1955	6.1	1973	18.0	1991	20.3
1956	6.1	1974	19.3	1992	20.9
1957	6.4	1975	17.6		

Source: U.S. Department of Agriculture, Economic Research Service, Agricultural Resources: Inputs Outlook and Situation Report, AR-28, (Washington, DC: DOA, October 1992).

Note: Quantity refers to tonnages of primary nutrients, nitrogen, phosphorus, and potash applied to farm fields and excludes fertilizer use on lawns, golf courses, home gardens, and other nonfarm lands.

Related Tables: 17, 22, 26, 31-34, 47-49, 51, 94.

Table 54.—Farm pesticide use, 1964-1992.

Year	Herbicides	Insecticides	Fungicides	Total
		million pounds of active ingredients		
1964	76	143	72	291
1966	112	138	79	328
1971	207	127	130	464
1976	374	130	146	650
1982	451	71	30	552
1986	410	59	6	475
1987	365	57	7	429
1988	372	60	8	440
1989	394	61	8	463
1990	392	63	8	463
1991	403	66	9	478
1992	412	67	8	487

Source: U.S. Department of Agriculture, Economic Research Service, Agricultural Resources: Inputs Outlook and Situation Report, AR-28, (Washington, DC: DOA, October 1992).

Notes: For the years 1964, 1966, 1972, and 1976, estimates of pesticide use are for total use on all crops in the United States. The 1982 estimates are for major field and forage crops only and represent 33 major producing states, excluding California. The 1986-1992 estimates are for major U.S. field crops. Data for 1992 are projections. Detail may not agree with totals because of independent rounding.

Related Tables: 17, 22, 31-33, 47-51, 76, 77, 80, 82, 83, 94, 99, 100.

Table 55.—Irrigated farmland, 1900-1992.

Year	Leading irrigation states	Other states	Total
		million acres	
1900	7.5	0.3	7.8
1910	11.3	0.4	11.7
1920	13.9	0.6	14.5
1930	14.1	0.6	14.7
1940	17.2	0.7	18.0
1950	24.3	1.5	25.8
1959	30.7	2.4	33.2
1964	33.2	3.8	37.1
1969	34.8	4.3	39.1
1974	37.2	4.0	41.2
1978	47.8	2.6	50.4
1982	46.1	2.9	49.0
1984	42.1	2.6	44.7
1987	42.1	4.1	46.2
1992	46.7	5.3	52.1

Source: U.S. Department of Commerce, Bureau of the Census, Census of Agriculture and Other Special Ranch and Irrigation Surveys, (Washington, DC: DOC: periodic).

U.S. Department of Agriculture, Economic Research Service, Agricultural Resources: Inputs Outlook and Situation Report, AR-28, and unpublished estimates for 1992, (Washington, DC: DOA, October 1992).

Notes: Leading irrigation states for 1900-1974 are the 17 western states: Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Leading states for 1978-1987 are the 17 western states plus Arkansas, Florida, and Louisiana. Data are derived from the Census of Agriculture, except for 1992 estimates which are based on the National Agricultural Statistics Service (NASS) annual estimates of irrigated acreage. Not included in census data are estimates for horticultural specialty, abnormal farms, or farms which did not irrigate in the preceding census year.

Related Tables: 27-29, 31-33, 47-49, 51.

Table 56.—Condition of nonfederal rangeland, 1963-1987, and Bureau of Land Management rangeland, 1936-1991.

Rangeland condition	Nonfederal				Bureau of Land Management				
	1963	1977	1982	1987	1936	1966	1975	1986	1991
	% rangeland acreage								
Excellent	5	12	4	3	2	2	2	4	5
Good	15	28	30	30	14	17	15	30	31
Fair	40	42	45	47	48	52	50	41	36
Poor	40	18	16	14	36	30	33	18	15
Unclassified	na	na	5	6	na	na	na	na	13

Source: U.S. Department of Agriculture, Soil Conservation Service, National Resources Inventory for 1977, 1982, and 1987 and earlier surveys, (Washington, DC: DOA).

U.S. Department of the Interior, Bureau of Land Management, Public Land Statistics, (Washington, DC: DOI, annual).

Notes: BLM=Bureau of Land Management. na=not available. Data are not strictly comparable because of different survey methods. BLM data are expressed in degree of similarity of present vegetation to potential natural, or climax, plant community: Excellent=76-100% similarity; Good=51-75% similarity; Fair=26-50% similarity; and Poor=0-25% similarity. Unclassified included rangeland for which data and estimates are not available. BLM data are based on information from ecological site inventories (49% of the public lands), from estimates based on earlier inventories (30% of the public lands), and from estimates based on professional judgement alone (21% of the public lands). Data are updated annually to reflect new information and changes in range condition classes.

Related Tables: 45, 50, 51.

Table 57.—Timberland in the United States, by ownership, 1952-1987.

Year	Farmer	Other private	Forest industry	National forests	Other public	Total
			million acres			
1952	172.8	124.3	59.0	94.7	58.1	508.9
1962	143.6	157.6	61.4	96.8	55.6	515.1
1970	124.4	161.9	67.6	94.6	55.6	504.1
1977	114.5	163.5	68.9	88.7	55.5	491.1
1987	97.0	179.4	70.6	85.2	51.1	483.3

Source: U.S. Department of Agriculture, Forest Service, Forest Statistics of the United States, 1987, Resource Bulletin PNW-RB-168, (Washington, DC: DOA, 1989).

Related Tables: 45, 50, 58-62, 75.

Table 58.—Annual growth and removal of timber stocks, 1952-1986, and volume of timber stocks, 1952-1987.

Growth and removal of timber stocks

Year	Farmer & other private		Forest industry		National forest		Other public forests		Total	
	Growth	Removal	Growth	Removal	Growth	Removal	Growth	Removal	Growth	Removal
					billion cubic feet					
1952	8.1	6.9	2.6	3.3	2.1	1.1	1.2	0.6	14.0	11.9
1962	9.5	6.4	3.2	3.0	2.5	1.9	1.6	0.7	16.8	12.0
1970	11.3	7.0	3.7	3.8	2.9	2.3	1.9	1.0	19.8	14.1
1976	12.6	6.8	4.2	4.2	3.1	2.1	2.0	1.1	21.9	14.2
1986	12.4	8.2	4.4	5.4	3.4	2.2	2.4	1.2	22.6	17.0

Volume of softwood and hardwood timber stocks

Year	Farmer & other private		Forest industry		National forests		Other public		Total	
	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood	Softwood	Hardwood
					billion cubic feet					
1952	93.5	130.67	7.11	9.920	4.41	3.35	5.1	16.44	30.1	180.2
1962	102.9	149.0	75.7	25.0	213.6	16.9	55.6	20.6	447.9	211.5
1970	113.8	164.5	75.1	28.8	211.8	18.8	57.3	23.8	458.1	235.9
1977	123.7	181.3	74.1	31.8	208.0	21.0	58.9	26.3	464.6	260.4
1987	135.3	213.9	72.3	34.9	186.4	24.7	56.8	31.5	450.9	305.1

Source: U.S. Department of Agriculture, Forest Service, Forest Statistics of the United States, 1987, Resource Bulletin PNW-RB-168, (Washington, DC: DOA, 1989).

Related Tables: 45, 57, 59, 60.

Table 59.—Roundwood production, by major product, 1950-1990.

Year	Lumber	Plywood & veneer	Pulp products	Fuel	Miscellaneous	Total
			billion cubic feet			
1950	5.9	0.3	1.5	2.3	0.8	10.8
1951	5.8	0.4	1.8	2.2	0.7	11.0
1952	5.8	0.4	1.8	2.0	0.7	10.8
1953	5.7	0.5	1.9	1.9	0.7	10.7
1954	5.6	0.5	2.0	1.8	0.7	10.6
1955	5.8	0.6	2.2	1.7	0.7	11.0
1956	5.9	0.6	2.5	1.7	0.6	11.3
1957	5.1	0.6	2.4	1.6	0.6	10.2
1958	5.2	0.6	2.2	1.5	0.6	10.0
1959	5.7	0.7	2.4	1.4	0.6	10.8
1960	5.1	0.7	2.6	1.3	0.6	10.2
1961	4.9	0.8	2.5	1.2	0.6	10.0
1962	5.1	0.8	2.6	1.1	0.6	10.2
1963	5.4	0.9	2.7	1.1	0.7	10.6
1964	5.6	1.0	2.9	1.0	0.7	11.2
1965	5.7	1.0	3.1	0.9	0.8	11.5
1966	5.6	1.0	3.2	0.8	0.8	11.5
1967	5.3	1.0	3.2	0.8	0.9	11.2
1968	5.5	1.1	3.4	0.7	1.0	11.8
1969	5.4	1.1	3.6	0.6	1.0	11.6
1970	5.2	1.0	3.8	0.5	1.0	11.6
1971	5.4	1.2	3.6	0.5	0.9	11.5
1972	5.5	1.3	3.5	0.5	1.1	11.9
1973	5.7	1.3	3.8	0.5	1.2	12.4
1974	5.1	1.1	4.2	0.5	1.1	12.1
1975	4.9	1.2	3.5	0.6	1.0	11.1
1976	5.6	1.4	3.8	0.6	1.2	12.5
1977	5.9	1.4	3.6	1.0	1.2	13.2
1978	6.2	1.5	3.7	1.5	1.2	14.1
1979	6.1	1.4	4.1	2.2	1.4	15.2
1980	5.3	1.2	4.4	3.1	1.2	15.2
1981	4.8	1.2	4.1	3.2	0.9	14.3
1982	4.6	1.1	4.0	3.4	1.1	14.3
1983	5.4	1.4	4.2	3.2	1.1	15.3
1984	5.8	1.4	4.4	3.6	1.2	16.3
1985	5.7	1.4	4.2	3.4	1.2	16.0
1986	6.5	1.5	4.5	3.1	1.2	17.0
1987	7.0	1.7	4.7	3.1	1.4	17.8
1988	6.9	1.6	4.7	3.4	1.5	18.2
1989	6.8	1.6	5.0	3.4	1.6	18.3
1990	6.5	1.6	5.1	3.3	1.5	18.0

Source: U.S. Department of Agriculture, Forest Service, U.S. Timber Production, Trade, Consumption, and Price Statistics, 1960-1988, table 4, p. 13, and unpublished data, (Washington, DC: DOA, 1991).

Notes: Miscellaneous=log and pulp chip exports and other products not specified. Data for 1988-1990 are preliminary. Totals may not agree with detail because of rounding.

Related Tables: 31, 58, 60.

Table 60.—Roundwood consumption, by major product, 1900-1988.

Year	Industrial roundwood consumption					Net Imports	Fuelwood consumption
	Lumber	Plywood & veneer	Pulp products	Miscellaneous	Total		
	billion cubic feet					%	bil. cub. ft.
1900	5.51	0.01	0.17	1.46	7.14	1.96	4.80
1905	6.60	0.04	0.26	1.64	8.54	1.05	4.05
1910	6.70	0.09	0.36	2.08	9.22	0.80	3.91
1915	5.72	0.09	0.47	1.89	8.15	1.65	3.98
1920	5.38	0.08	0.63	1.89	7.98	2.57	4.07
1925	6.26	0.14	0.83	1.50	8.71	4.13	3.22
1930	4.39	0.15	0.98	1.20	6.71	5.96	3.79
1935	3.63	0.14	1.05	0.90	5.52	7.62	4.52
1940	4.81	0.23	1.37	0.97	7.41	5.67	3.89
1945	4.47	0.24	1.72	0.85	7.29	9.40	2.84
1950	6.36	0.35	2.39	0.77	9.91	13.93	2.27
1955	6.22	0.62	3.00	0.63	10.50	12.10	1.73
1960	5.56	0.77	3.29	0.51	10.15	12.03	1.30
1965	6.34	1.13	3.89	0.56	11.93	11.61	0.91
1970	5.97	1.17	4.40	0.43	12.00	20.26	0.54
1975	5.57	1.27	3.88	0.39	11.11	19.95	0.57
1980	6.45	1.25	4.89	0.42	13.02	24.95	3.11
1985	7.70	1.55	5.06	0.47	14.79	29.35	3.45
1988	8.43	1.70	5.59	0.51	16.23	26.79	3.36

Source: U.S. Department of Commerce, Bureau of the Census, Historical Statistics of the United States: Colonial Times to 1970, part 1, series L-72-86, L96, (Washington, DC: DOC, BOC, 1976).

U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States, table 1136, (Washington, DC: DOC, BOC, 1992).

Notes: Miscellaneous=cooperage logs, poles and pilings, fence posts, hewn ties, round mine timbers, box bolts, etc. Consumption of industrial roundwood includes log imports.

Related Tables: 22, 58, 59.

Table 61.—Forest fire damage and tree planting, 1930-1991.

Year	Forest fire damage	Reforestation	Year	Forest fire damage	Reforestation
	million acres			*million acres*	
1930	52.3	0.14	1970	3.3	1.60
1940	25.9	0.52	1971	4.3	1.69
1950	15.5	0.50	1972	2.6	1.68
1951	10.8	0.45	1973	1.9	1.75
1952	14.2	0.52	1974	2.9	1.60
1953	10.0	0.71	1975	1.8	1.93
1954	8.8	0.81	1976	5.1	1.89
1955	8.1	0.78	1977	3.2	1.98
1956	6.6	0.89	1978	3.9	2.09
1957	3.4	1.14	1979	3.0	2.06
1958	3.3	1.53	1980	5.3	2.27
1959	4.2	2.12	1981	4.8	1.93
1960	4.5	2.14	1982	2.4	2.37
1961	3.0	1.76	1983	5.1	2.45
1962	4.1	1.37	1984	3.0	2.55
1963	7.1	1.33	1985	5.2	2.70
1964	4.2	1.31	1986	3.2	2.75
1965	2.7	1.29	1987	5.0	3.03
1966	4.6	1.28	1988	5.7	3.39
1967	4.7	1.37	1989	3.5	3.02
1968	4.2	1.44	1990	4.6	2.86
1969	6.7	1.43	1991	na	2.56

Source: U.S. Department of Agriculture, Forest Service, Wildfire Statistics, (Washington, DC: DOA, annual).

U.S. Department of Agriculture, Forest Service, U.S. Forest Planting Report, (Washington, DC: DOA, annual).

Note: Reforestation refers to acres planted in seedlings and direct seeded.

Related Tables: 28, 46, 50, 57, 58, 62.

Table 62.—Forestland damaged by insects, 1968-1991.

Year	Eastern spruce budworm	Western spruce budworm	Gypsy moth	Mountain pine beetle	Southern pine beetle
			million acres		
1968	1.3	5.3	0.1	na	na
1969	1.2	4.6	0.3	na	na
1970	2.0	4.0	1.0	na	na
1971	1.6	4.8	1.9	na	na
1972	2.8	5.5	1.4	na	na
1973	4.2	4.4	1.8	na	na
1974	10.8	5.5	0.8	na	na
1975	9.2	5.3	0.5	na	na
1976	9.1	5.8	0.9	na	na
1977	10.3	6.5	1.6	na	na
1978	7.7	5.2	1.3	4.0	na
1979	6.6	5.0	0.6	4.4	15.0
1980	6.6	4.0	5.0	4.7	12.1
1981	4.5	5.5	12.9	4.7	0.9
1982	4.2	8.7	8.2	4.2	7.3
1983	6.5	11.0	2.4	3.6	11.4
1984	6.1	10.6	1.0	3.3	na
1985	5.2	12.8	1.7	3.3	15.5
1986	1.0	13.2	2.4	3.5	26.4
1987	0.8	8.0	1.3	2.4	13.8
1988	0.3	6.1	0.7	2.2	7.9
1989	0.1	3.1	3.0	1.6	5.3
1990	0.2	4.6	7.3	0.9	4.2
1991	0.1	7.2	4.2	0.6	10.7

Source: U.S. Department of Agriculture, Forest Service, Forest Pest Management, Insect and Disease Conditions in the United States, 1979-1983, (Washington, DC: DOA, 1985).

U.S. Department of Agriculture, Forest Service, Forest Pest Management, Insect and Disease Conditions in the United States, (Washington, DC: DOA, annual from 1986).

Note: na=not available.

Related Tables: 37, 57, 61.

Table 63.—Wetlands losses, by type, 1970s-1980s.

Wetlands type	1970s	1980s	Change
	million acres		*%*
Estuarine wetlands	5.53	5.47	- 1.1
Palustrine marshes	24.31	24.53	0.9
Palustrine shrub wetlands	15.51	15.35	- 1.0
Palustrine forested wetlands	55.15	51.75	- 6.2
Palustrine nonvegetated wetlands	5.35	6.14	14.8
Lacustrine wetlands	57.64	57.84	0.4
Riverine wetlands	5.12	5.19	1.3
Total wetland acreage	168.61	166.27	- 1.0

Source: Dahl, T.E. & C.E. Johnson, Status and Trends of Wetlands in the Conterminous United States, 1970s to 1980s, table 2, p. 8, (Washington, DC: DOI, FWS, 1991).

Related Tables: 6, 17, 18, 46, 48, 75, 78, 79, 84, 86, 87.

Table 64.—Wetlands losses, by state, 1780s-1980s.

State	Total surface area of state	Wetlands area		Wetlands losses
		1780s	1980s	
		million acres		*%*
Alabama	33.03	7.57	3.78	50
Alaska	375.30	170.20	170.00	<1
Arizona	72.90	0.93	0.60	36
Arkansas	33.99	9.85	2.76	72
California	101.56	5.00	0.45	91
Colorado	66.72	2.00	1.00	50
Connecticut	3.21	0.67	0.18	74
Delaware	1.32	0.48	0.22	54
Florida	37.48	20.33	11.04	46
Georgia	37.68	6.84	5.30	23
Hawaii	4.12	0.06	0.05	12
Idaho	53.47	0.88	0.39	56
Illinois	36.10	8.21	1.25	85
Indiana	23.23	5.60	0.75	87
Iowa	36.03	4.00	0.42	89
Kansas	52.65	0.84	0.44	48
Kentucky	25.85	1.57	0.30	81
Louisiana	31.05	16.19	8.78	46
Maine	21.26	6.46	5.20	20
Maryland	6.77	1.65	0.44	73
Massachusetts	5.28	0.82	0.59	28
Michigan	37.26	11.20	5.58	50
Minnesota	53.80	15.07	8.70	42
Mississippi	30.54	9.87	4.07	59
Missouri	44.60	4.84	0.64	87
Montana	94.17	1.15	0.84	27
Nebraska	49.43	2.91	1.91	35
Nevada	70.75	0.49	0.24	52

continued

Table 64 (continued).—Wetlands losses, by state, 1780s-1980s.

State	Total surface area of state	Wetlands area		Wetlands losses
		1780s	1980s	
	million acres			%
New Hampshire	5.95	0.22	0.20	9
New Jersey	5.02	1.50	0.92	39
New Mexico	77.87	0.72	0.48	33
New York	31.73	2.56	1.03	60
North Carolina	33.66	11.09	5.69	49
North Dakota	45.23	4.93	2.49	49
Ohio	26.38	5.00	0.48	90
Oklahoma	44.75	2.84	0.95	67
Oregon	62.07	2.26	1.39	38
Pennsylvania	29.01	1.13	0.50	56
Rhode Island	0.78	0.10	0.07	37
South Carolina	19.88	6.41	4.66	27
South Dakota	49.31	2.74	1.78	35
Tennessee	27.04	1.94	0.79	59
Texas	171.10	16.00	7.61	52
Utah	54.35	0.80	0.56	30
Vermont	6.15	0.34	0.22	35
Virginia	26.12	1.85	1.07	42
Washington	43.64	1.35	0.94	31
West Virginia	15.48	0.13	0.10	24
Wisconsin	35.94	9.80	5.33	46
Wyoming	62.66	2.00	1.25	38

Source: Dahl, T.E, Wetlands Losses in the United States 1780s to 1980s, Report to Congress, (Washington, DC: DOI, FWS, 1991).

Related Tables: 5, 6, 17, 18, 46, 48, 63, 75, 78, 79, 84, 86, 87.

Table 65.—Coastal wetlands distribution, by region and habitat, 1980s.

Region	Salt marsh	Fresh marsh	Forested & shrub	Tidal flats	Total
			thousand acres		
North Atlantic	68.00	58.30	927.60	142.80	1,196.80
Middle Atlantic	689.60	120.80	1,540.10	256.10	2,606.70
South Atlantic	894.20	1,311.60	5,943.20	101.60	8,250.50
Gulf of Mexico	2,496.60	2,751.10	8,211.80	507.50	13,967.00
Pacific	121.90	291.20	757.10	200.10	1,370.30
National total	4,270.30	4,532.80	17,380.20	1,208.00	27,391.20

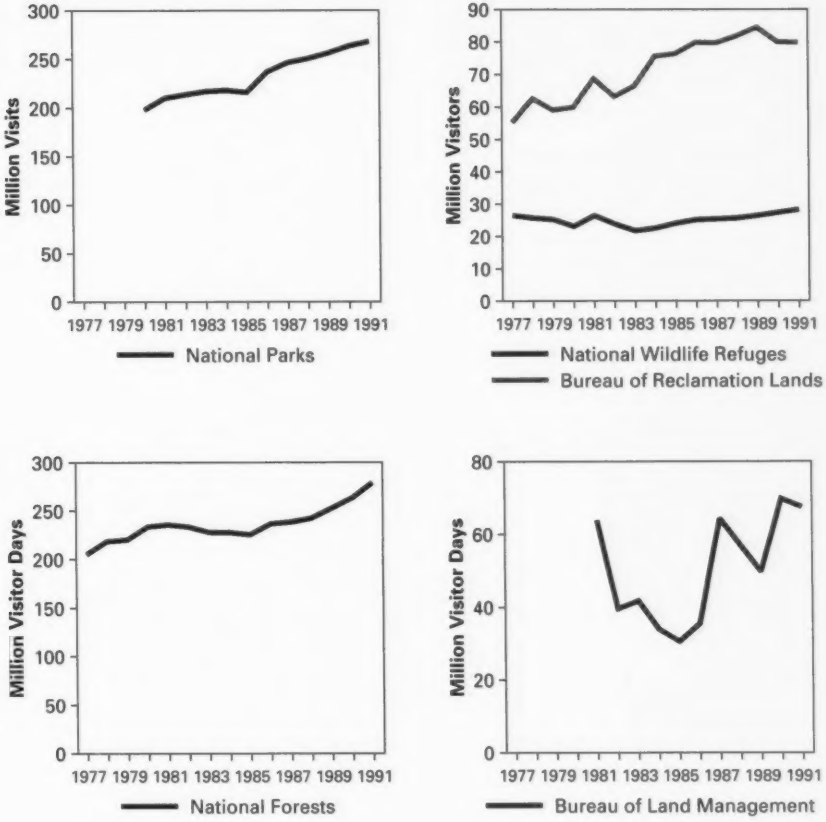
Source: Field, D.W., A.J. Reyer, P.V. Genovese, and B.D. Shearer, Coastal Wetlands of the United States: An Accounting of a Valuable National Resource, (Washington, DC: DOC, NOAA, 1991).

Note: Data are not directly comparable to those presented in Table 63 because different quantitative methods were used for estimating wetland acreages by type. Coastal wetlands include all wetland areas (in addition to tidal wetlands) shown on FWS National Wetland Inventory maps within counties adjacent to marine waters (excluding Alaska and Hawaii).

Related Tables: 5, 6, 17, 18, 46, 48, 63, 64, 75, 78, 79, 84, 86, 87.

Protected Lands

Figure 29.—Visits to selected federal lands, 1977-1991.



Source: See Table 74.

Table 66.—National Park System, 1872-1992.

Year	Units	Land
	number	*million acres*
1872	1	2.2
1880	5	2.2
1890	12	3.8
1900	17	4.1
1910	45	7.9
1920	62	9.9
1930	98	10.8
1940	161	22.3
1950	182	24.6
1960	187	26.2
1970	282	29.6
1980	333	77.0
1991	358	80.3
1992	362	80.7

Source: U.S. Department of the Interior, National Park Service, Areas Administered by the National Park Service: Information Tables, (Washington, DC: DOI, annual).

Table 67.—National Wildlife Refuge System, 1920-1992.

Year	Units	Land
	number	*million acres*
1920	36	na
1940	174	na
1946	242	17.5
1950	246	17.1
1955	276	17.3
1960	275	17.3
1965	299	28.4
1970	332	29.2
1975	378	32.3
1978	390	32.6
1980	419	69.9
1985	432	88.3
1991	503	88.5
1992	485	88.6

Source: U.S. Department of the Interior, Fish and Wildlife Service, Lands Under the Control of the Fish and Wildlife Service, (Washington, DC: DOI, annual).

Note: na=not available. The U.S. Fish and Wildlife Service manages an additional 2.4 million acres, as shown in Table 73.

Table 68.—National Forest System, 1891-1991.

Year	Forests	Land	Year	Forests	Land
	number	*million acres*		*number*	*million acres*
1891	1	1.24	1945	155	177.64
1895	17	17.93	1950	151	179.69
1900	38	46.52	1955	149	180.30
1905	83	75.35	1960	151	180.84
1910	149	168.03	1965	154	182.14
1915	162	162.77	1970	154	182.57
1920	152	156.03	1975	155	183.28
1925	159	158.40	1980	155	183.06
1930	149	160.09	1985	156	186.31
1935	142	163.31	1990	156	187.08
1940	160	174.77	1991	156	187.00

Source: U.S. Department of Agriculture, Forest Service, Land Areas of the National Forest System, (Washington, DC: DOA, annual).

Related Tables: 12, 45, 46, 69-74.

Table 69.—National Wilderness Preservation System, 1964-1991.

Year	Land	Year	Land	Year	Land
	million acres		*million acres*		*million acres*
1964	9.24	1974	11.38	1984	88.55
1965	9.24	1975	12.72	1985	88.70
1966	9.24	1976	14.45	1986	88.80
1967	9.24	1977	14.49	1987	88.99
1968	10.03	1978	19.00	1988	90.81
1969	10.19	1979	19.00	1989	91.46
1970	10.40	1980	79.71	1990	94.97
1971	10.40	1981	79.84	1991	95.03
1972	11.03	1982	79.88		
1973	11.03	1983	80.21		

Source: U.S. Department of Agriculture, Forest Service, National Wilderness Preservation System Fact Sheet, (Washington, DC: DOA, annual).

Related Tables: 12, 45, 46, 66-68, 70-74.

Table 70.—National Wild and Scenic River System, 1968-1992.

Year	Cumulative length	Year	Cumulative length	Year	Cumulative length
	miles		*miles*		*miles*
1968	773	1977	1,610	1986	7,363
1969	773	1978	2,299	1987	7,709
1970	868	1979	2,299	1988	9,264
1971	868	1980	5,662	1989	9,281
1972	895	1981	6,908	1990	9,318
1973	961	1982	6,908	1991	9,463
1974	1,018	1983	6,908	1992	10,506
1975	1,145	1984	7,217		
1976	1,610	1985	7,224		

Source: U.S. Department of the Interior, National Park Service, River Mileage Classifications for Components of the National Wild and Scenic River System, (Washington, DC: unpublished data).

Related Tables: 12, 45, 46, 66-69, 71-74.

Table 71.—National Estuarine Research Reserves and National Marine Sanctuaries, 1975-1992.

Year	Estuarine Research Reserves		Marine Sanctuaries	
	Units	Area	Units	Area
	number	*acres*	*number*	*acres*
1975	1	4,700	2	64,640
1976	3	14,205	2	64,640
1977	3	14,205	2	64,640
1978	4	22,605	2	64,640
1979	5	216,363	2	64,640
1980	9	223,426	3	865,920
1981	11	229,652	6	1,486,720
1982	14	240,571	6	1,486,720
1984	15	242,121	6	1,486,720
1986	16	245,149	7	1,487,360
1987	16	245,149	7	1,487,360
1988	17	247,348	7	1,487,360
1989	18	253,477	8	1,741,440
1990	18	259,945	9	4,412,480
1991	19	399,302	9	4,412,480
1992	21	400,559	13	9,087,232

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Sanctuaries and Reserves Division, (Washington, DC: unpublished data).

Related Tables: 12, 45, 46, 66-70, 72-74.

Table 72.—National Register of Historic Places, 1967-1992.

Year	Properties listed	Properties removed	Year	Properties listed	Properties removed
1967	873	2	1980	24,680	403
1968	903	3	1981	26,499	406
1969	1,106	4	1982	29,999	420
1970	1,888	19	1983	35,112	434
1971	3,026	51	1984	39,121	440
1972	4,376	93	1985	42,538	445
1973	6,646	144	1986	45,936	452
1974	8,247	188	1987	48,254	525
1975	10,805	231	1988	51,286	574
1976	12,561	265	1989	53,838	635
1977	14,203	290	1990	56,688	651
1978	16,575	338	1991	58,209	756
1979	20,589	366	1992	60,071	781

Source: U.S. Department of the Interior, National Park Service, The National Register of Historic Places, (Washington, DC: unpublished data).

Note: Data reflect year-end cumulative totals, except for 1992 which reflect cumulative totals as September 30.

Related Tables: 12, 66-71.

Table 73.—Distribution of protected areas within selected federal lands, 1991.

National Forest System	Land area	
	acres	*%*
National Wilderness Areas	33,631,802	17.985
National Primitive Areas	173,762	0.093
National Scenic Research Areas	6,619	0.004
National Wild and Scenic Rivers	376,378	0.201
National Recreation Areas	2,335,752	1.249
National Game Refuges	1,218,953	0.652
National Monuments	3,249,238	1.738
Research and Experimental Areas	73,152	0.039
Total protected area	40,992,504	21.922
Total NFS land	186,996,286	

Bureau of Land Management	Land area	
	acres	*%*
National Wilderness Areas	1,610,995	0.598
Areas of Critical Environmental Concern	8,259,212	3.064
Research Natural Areas	179,287	0.067
National Natural Landmarks	570,027	0.211
National Conservation Areas	13,833,431	5.132
Total protected area	24,452,952	9.072
Total BLM land	269,553,883	

Fish and Wildlife Service	Land area	
	acres	*%*
National Wildlife Refuges	86,615,896	97.353
Waterfowl Protection Areas	2,015,072	2.265
Waterfowl Coordination Areas	315,797	0.355
Wildlife Research Centers	647	0.001
Administrative Sites	1,032	0.001
National Fish Hatcheries	19,754	0.022
Fishery Research Stations	2,574	0.003
Total FWS land	88,970,772	

Source: U.S. Department of Agriculture, Forest Service, Land Areas of the National Forest System, (Washington, DC: DOA, February 1992).

U.S. Department of the Interior, Fish and Wildlife Service, Lands Under the Control of the Fish and Wildlife Service, (Washington, DC: DOI, September 1992).

U.S. Department of the Interior, Bureau of Land Management, Public Land Statistics, (Washington, DC: DOI, September 1992).

Related Tables: 12, 56, 57, 67, 68, 74.

Table 74.—Visits to areas administered by federal agencies, 1977-1991.

Year	National parks	Wildlife refuges	BOR	National forests	COE reservoirs	BLM
	million visits	*million visitors*		*million visitor days*		
1977	na	27	55	205	424	na
1978	na	26	63	219	439	na
1979	na	25	59	220	449	na
1980	198	23	60	234	457	na
1981	210	26	69	236	469	64
1982	214	24	63	233	480	40
1983	217	22	66	228	480	42
1984	218	23	76	228	482	34
1985	216	24	76	225	502	31
1986	237	25	80	237	506	36
1987	246	25	80	239	181	64
1988	251	26	82	242	191	57
1989	256	26	84	253	191	50
1990	263	27	80	263	190	70
1991	268	28	80	279	192	68

Source: U.S. Army Corps of Engineers, Directorate of Civil Works, Operations, Construction and Readiness Division, Natural Resources Management Branch, Visitation to Corps Recreation Areas, (Washington, DC: unpublished data).

U.S Department of Agriculture, Forest Service, Recreation Information Management System database, (Washington, DC: unpublished data).

U.S. Department of the Interior, Bureau of Land Management, Public Land Statistics, (Washington, DC: DOI, annual).

U.S. Department of the Interior, Bureau of Reclamation, Utilization of Recreation Areas on Reclamation Projects, (Denver, CO: data from the commissioner's annual reports).

U.S. Department of the Interior, Fish and Wildlife Service, Refuge Division, Public use statistics database through 1987, with estimates for 1988-1991, (Washington, DC: unpublished data).

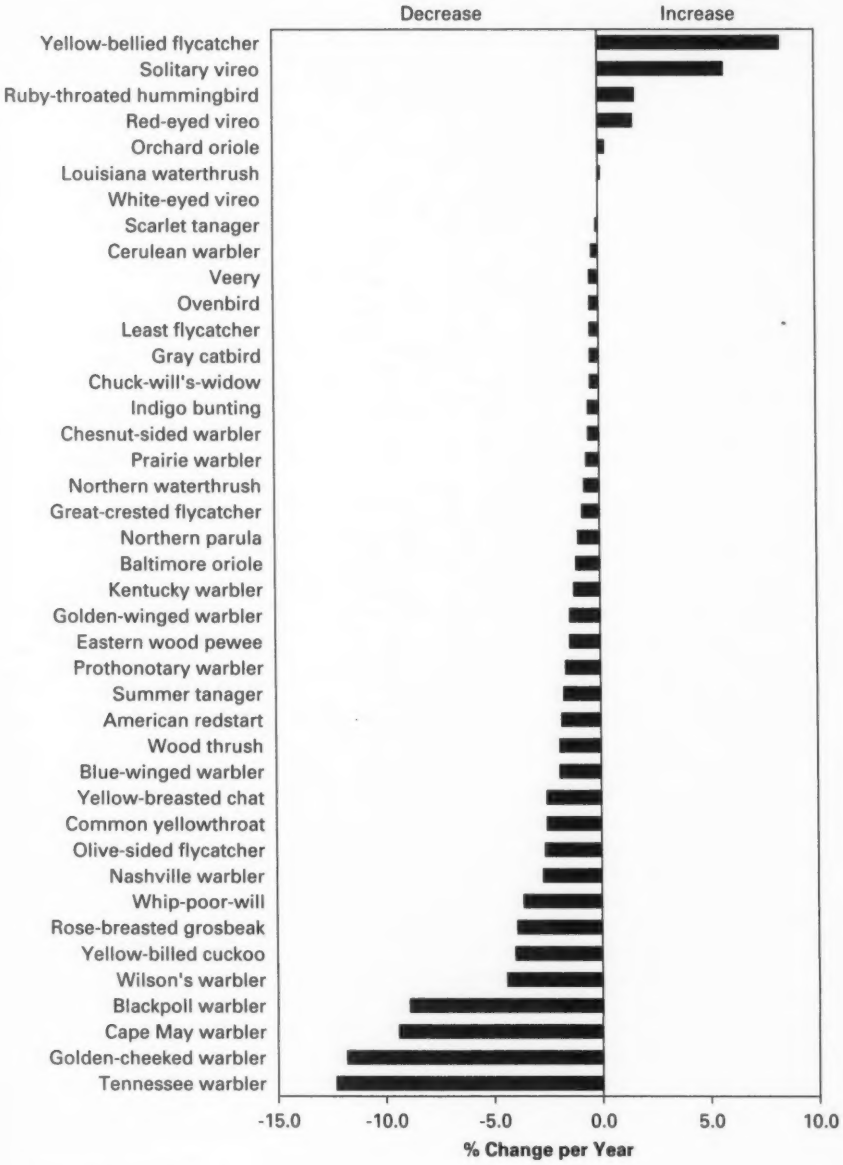
U.S. Department of the Interior, National Park Service, Statistical Office, National Park Statistical Abstract, (Denver, CO: DOI, annual).

Note: BLM=Bureau of Land Management. BOR=Bureau of Reclamation. COE=Corps of Engineers. Visitor days for BLM and National Forests are reported as 8-hour visitor days; for BOR as 12-hour visitor days; and for COE as recreation days of use (1977-1986) and visitor days (after 1986).

Related Tables: 12, 66-73.

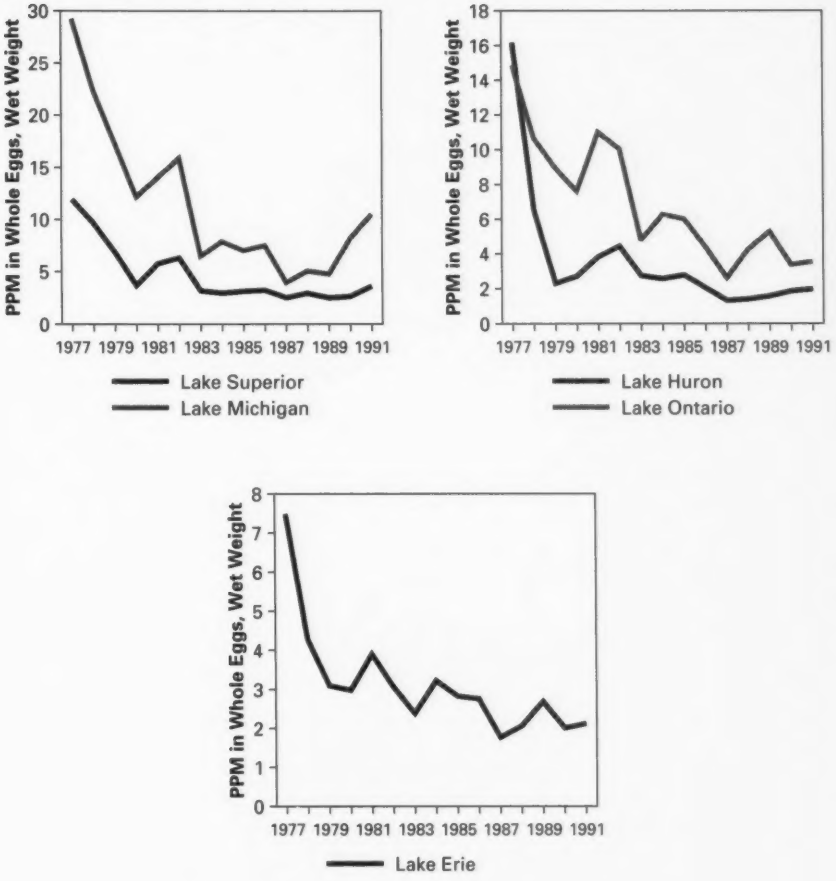
Wildlife and Fisheries

Figure 30.—Trends in selected neotropical migrant bird populations, 1982-1991.



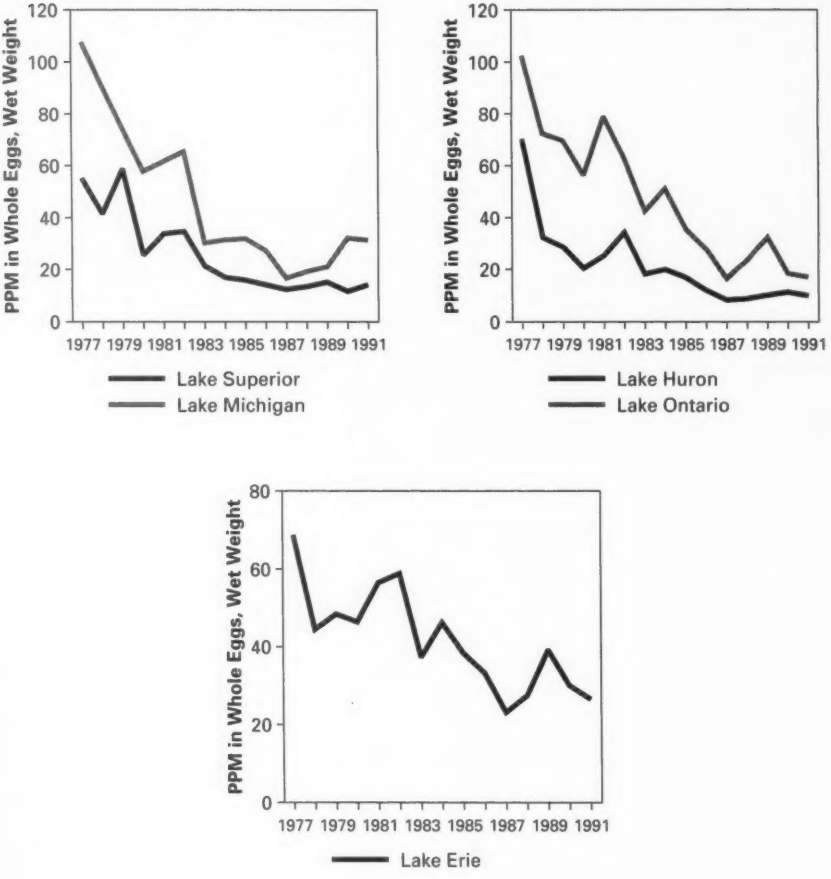
Source: See Table 75.

Figure 31.—DDE in herring gull eggs from Great Lakes colonies, 1977-1991.



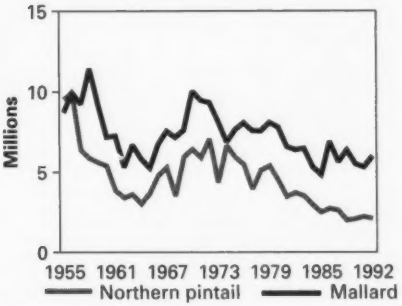
Note: PPM=parts per million.
Source: See Table 77.

Figure 32.—PCBs in herring gull eggs from Great Lakes colonies, 1977-1991.



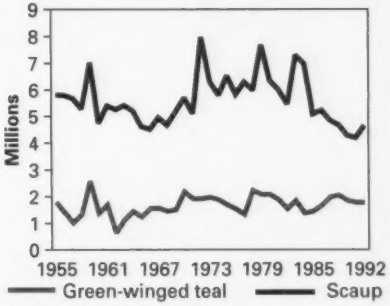
Note: PPM=parts per million.
Source: See Table 77.

Figure 33a.—Breeding population estimates for northern pintail and mallard, 1955-1992.



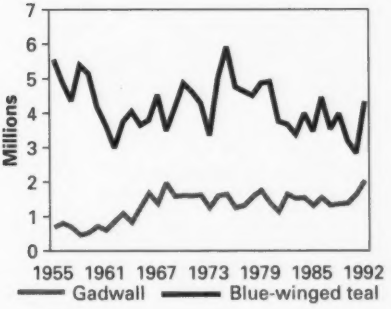
Source: See Table 78.

Figure 33b.—Breeding population estimates for green-winged teal and scaup, 1955-1992.



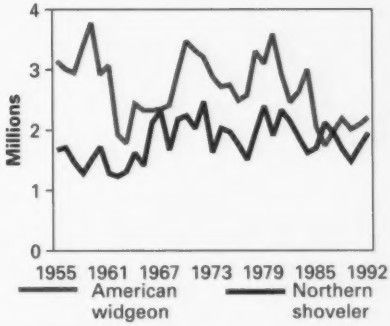
Source: See Table 78.

Figure 33c.—Breeding population estimates for gadwall and blue-winged teal, 1955-1992.



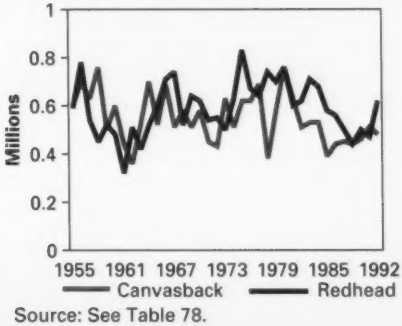
Source: See Table 78.

Figure 33d.—Breeding population estimates for American widgeon and northern shoveler, 1955-1992.



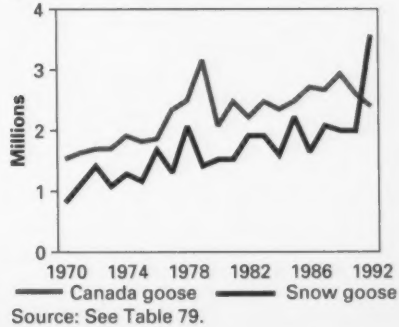
Source: See Table 78.

Figure 33e.—Breeding population estimates for canvasback and redhead, 1955-1992.



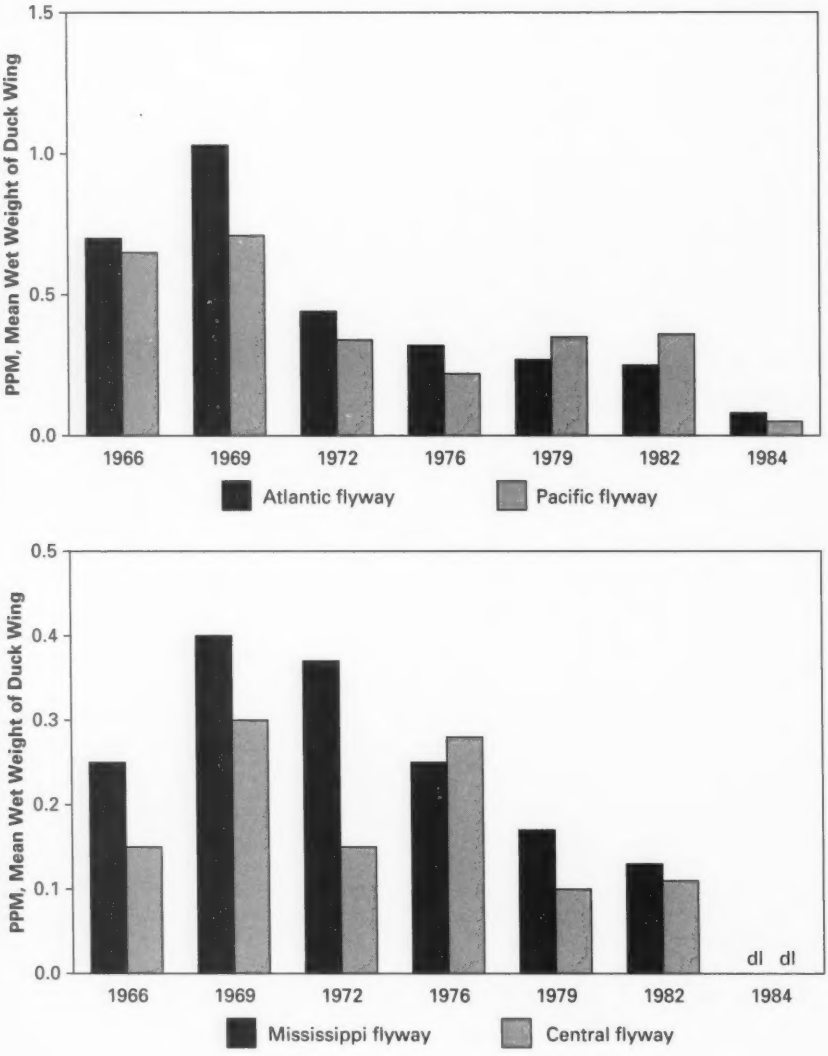
Source: See Table 78.

Figure 33f.—Population estimates for Canada goose and snow goose, 1970-1992.



Source: See Table 79.

Figure 34.—DDE in waterfowl, by flyway, 1966-1984.



Note: PPM=parts per million.
Source: See Table 80.

Figure 35.—Fishing and hunting in the United States, 1955-1991.

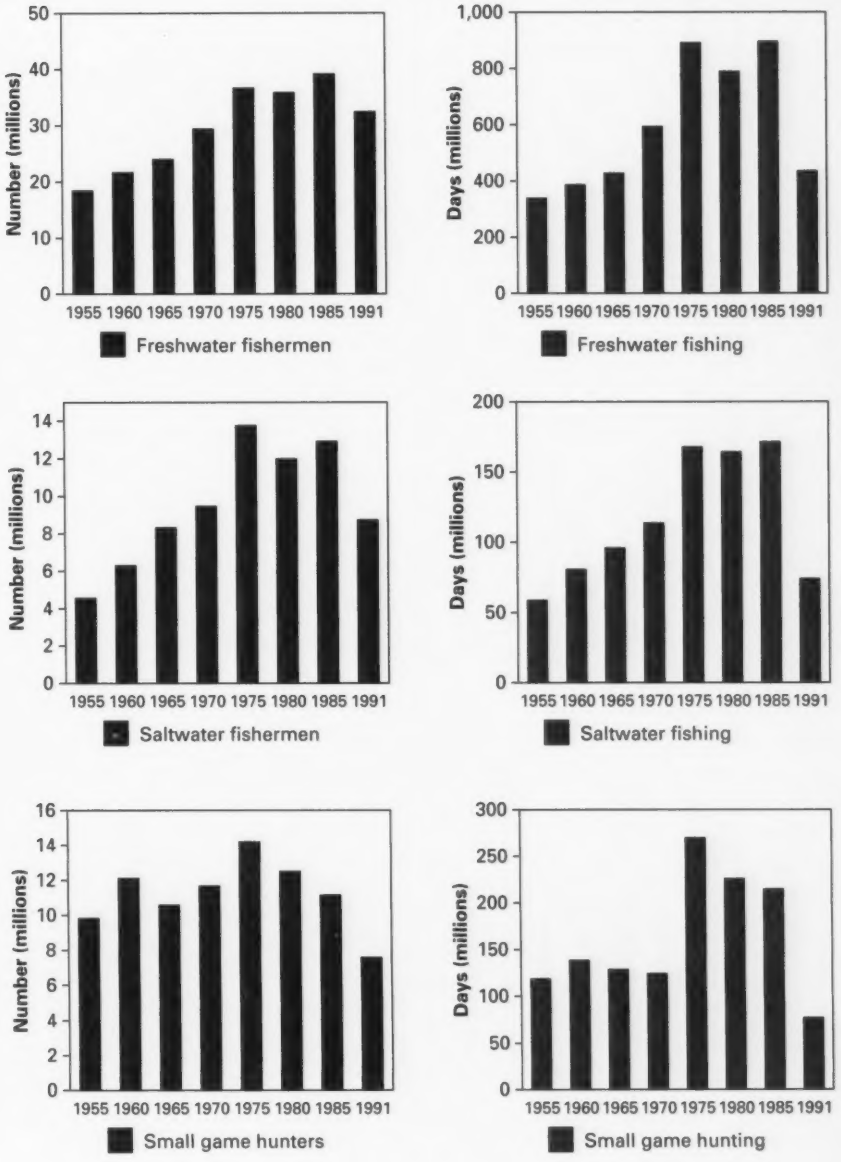
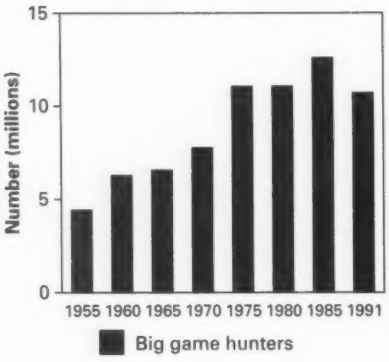
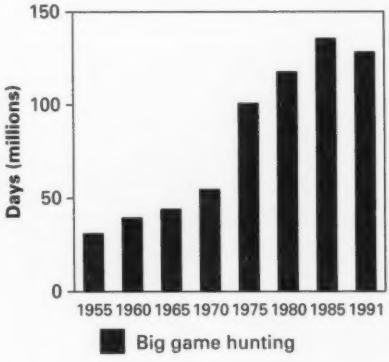
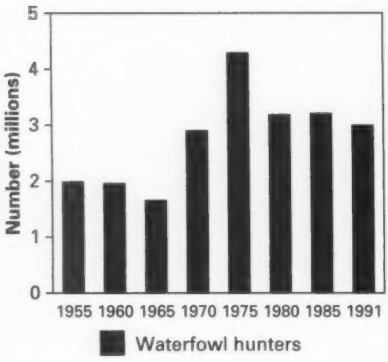
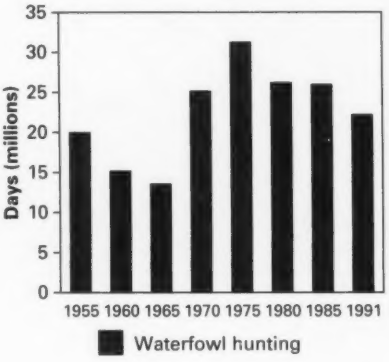


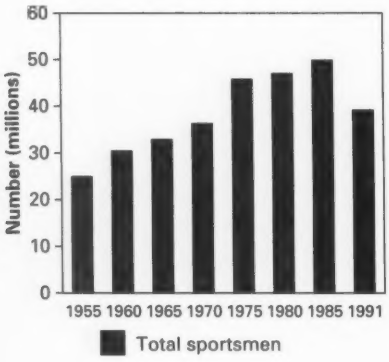
Figure 35. (continued)—Fishing and hunting in the United States, 1955-1991.

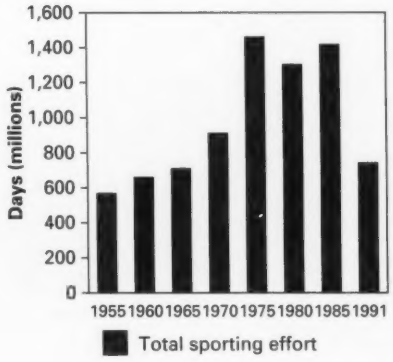






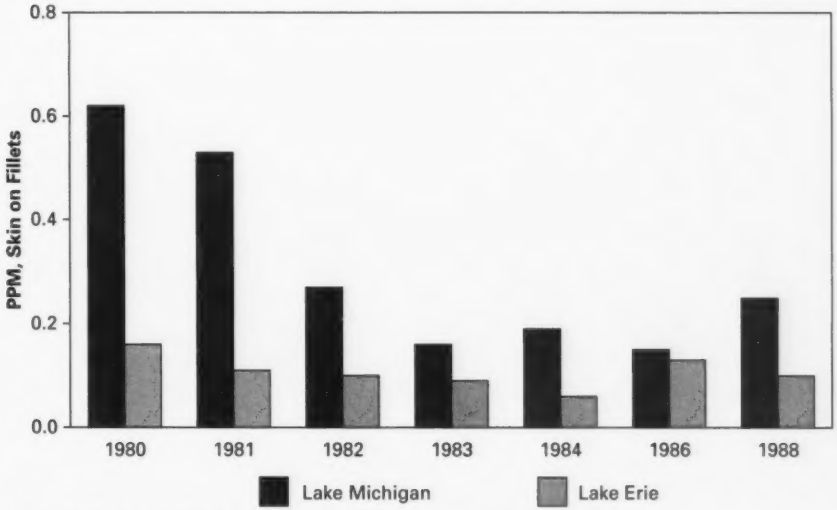






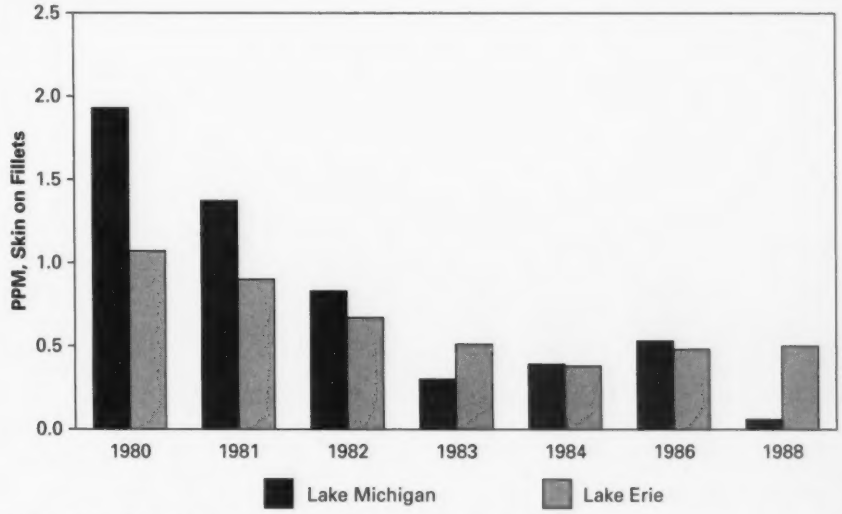
Source: See Table 81.

Figure 36a.—DDT in fall run coho salmon from the Great Lakes, 1980-1988.



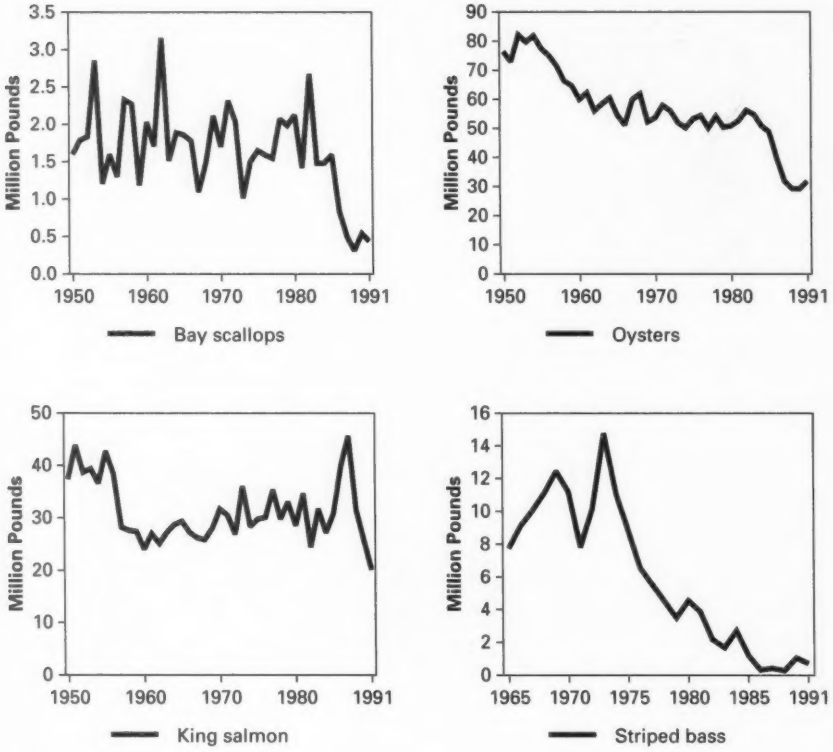
Note: DDT=Dichloro-diphenyl-trichloro ethane. PPM=parts per million.
Source: See Table 82.

Figure 36b.—PCBs in fall run coho salmon from the Great Lakes, 1980-1988.



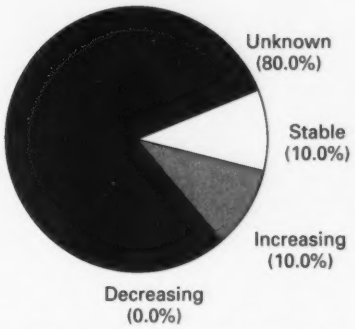
Note: PCBs=Polychlorinated biphenyls. PPM=parts per million.
Source: See Table 82.

Figure 37.—Commercial harvest of selected marine and estuarine fisheries in U.S. waters, 1950-1991.



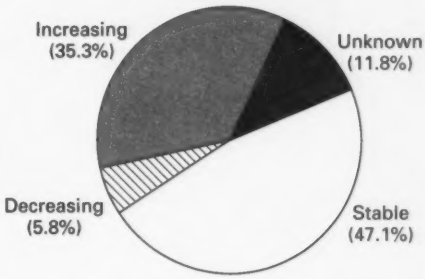
Source: See Table 84.

Figure 38a.—Status of Atlantic and Gulf of Mexico marine mammals, 1991.



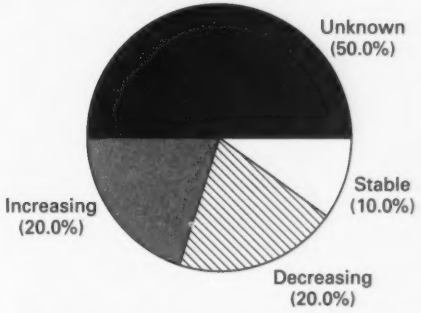
Note: Based on assessment of 10 species of marine mammals.
Source: See Table 86.

Figure 38b.—Status of Pacific marine mammals, 1991.



Note: Based on assessment of 17 species of Pacific marine mammals.
Source: See Table 86.

Figure 38c.—Status of female sea turtles that nest on U.S. beaches,1991.



Note: Based on assessment of 6 species of sea turtles.
Source: See Table 86.

Table 75.—Trends in selected resident and neotropical migrant birds, 1966-1991.

Common name	Resident birds	
	Long-term trend (1966-1991)	Short-term trend (1982-1991)
	% change per year	
Northern bobwhite	- 2.4	- 3.5
Great horned owl	0.5	- 2.5
Spotted owl	- 0.5	- 0.6
Downy woodpecker	0.3	- 0.1
Hairy woodpecker	1.1	1.2
Pileated woodpecker	1.2	0.4
Red-cockaded woodpecker	- 0.4	0.4
Black-capped chickadee	1.9	1.9
Carolina chickadee	- 0.4	- 1.4
Tufted titmouse	0.5	2.0
Brown-headed nuthatch	- 0.8	- 1.6
Carolina wren	0.9	2.8
Northern mockingbird	- 1.0	1.1
Northern cardinal	- 0.3	0.4
House sparrow	- 1.4	- 3.1

Common name	Neotropical migrant birds	
	Long-term trend (1966-1991)	Short-term trend (1982-1991)
	% change per year	
Yellow-billed cuckoo	- 1.3	- 4.0
Chuck-will's-widow	- 0.9	- 0.4
Whip-poor-will	- 1.0	- 3.6
Ruby-throated hummingbird	1.4	1.7
Eastern wood pewee	- 2.1	- 1.4
Least flycatcher	- 0.7	- 0.4
Olive-sided flycatcher	- 2.5	- 2.6
Yellow-bellied flycatcher	5.1	8.4
Great-crested flycatcher	0.0	- 0.8
Veery	- 1.0	- 0.4
Wood thrush	- 2.0	- 1.9
Gray catbird	- 0.5	- 0.4
White-eyed vireo	- 0.2	0.0
Red-eyed vireo	1.4	1.6
Solitary vireo	3.3	5.8
Golden-winged warbler	- 2.4	- 1.4
Tennessee warbler	4.5	-12.3
Northern parula	1.0	- 1.0

continued

Table 75 (continued).—Trends in selected resident and neotropical migrant birds, 1966-1991.

Common name	Neotropical migrant birds	
	Long-term trend (1966-1991)	Short-term trend (1982-1991)
	% change per year	
Cape May warbler	3.2	- 9.4
Golden-cheeked warbler	-11.8	-11.8
Blue-winged warbler	-0.1	- 1.9
Prairie warbler	-2.4	- 0.6
Cerulean warbler	- 2.7	- 0.3
Blackpoll warbler	3.0	- 8.9
Chestnut-sided warbler	- 0.5	- 0.5
Wilson's warbler	0.9	- 4.4
Nashville warbler	1.7	- 2.7
Kentucky warbler	- 0.7	- 1.2
American redstart	- 0.6	- 1.8
Prothonotary warbler	- 0.5	- 1.6
Ovenbird	0.7	- 0.4
Northern waterthrush	0.8	- 0.7
Louisiana waterthrush	- 1.4	0.1
Common yellowthroat	- 0.5	- 2.5
Yellow-breasted chat	- 0.5	- 2.5
Scarlet tanager	0.2	- 0.1
Summer tanager	- 0.2	- 1.7
Baltimore oriole	0.4	- 1.1
Orchard oriole	- 1.3	0.3
Rose-breasted grosbeak	0.0	- 3.9
Indigo bunting	- 1.6	- 0.5

Source: U.S. Fish and Wildlife Service, Breeding Bird Survey, (Laurel, MD, unpublished data).

Related Tables: 4, 6, 45, 46, 48, 54, 56, 58, 63, 66-71, 76, 77-80, 87.

Table 76.—Contaminant levels in starlings, 1968-1985.

Year	DDE	PCBs	Dieldrin
	parts per million, geometric mean wet weight		
1968	0.58	na	0.08
1970	0.36	0.36	0.04
1972	0.39	0.22	0.04
1974	0.23	0.07	0.02
1976	0.25	0.24	0.03
1979	0.17	0.05	0.01
1982	0.15	0.03	0.01
1985	0.11	*	0.01

Sources: Bunck, C.M., R.M. Prouty & A.J. Krynitsky, Residues of organochlorine pesticides and polychloribiphenyls in starlings (Sturnus vulgaris) from the continental United States, Environ. Monit. and Assess. 8:59-75 (1987).

Cain, B.W. & C.M. Bunck, Residues of organochlorine compounds in starlings (Sturnus vulgaris), 1979, Environ. Monit. Assess. 3:161-172 (1983).

Martin, W.E. & K.R. Barbehenn, Organochlorine residues in starlings, 1970, Pestic. Monit. J. 8:247-254 (1975).

U.S. Fish and Wildlife Service, unpublished data for 1985 samples, Patuxent, MD.

White, D.H., Nationwide residues of organochlorines in starlings, 1974, Pestic. Monit. J. 10:10-17 (1976).

White, D.H., Nationwide residues of organochlorines in starlings, 1976, Pestic. Monit. J. 12:193-197 (1979).

Notes: DDE=Derivative of Dichloro-diphenyl-trichloro ethane (DDT). PCBs=Polychlorinated biphenyls. *=PCBs were measurable in only 30% of the samples Historical data for PCBs not directly comparable because of different analytical chemistry procedures.

Related Tables: 17, 54, 77, 80, 82, 83, 94, 96, 97, 99, 100.

Table 77.—Contaminant levels in herring gull eggs from Great Lakes colonies, 1974-1991.

Year	Lake Superior				
	DDE	Dieldrin	Mirex	HCB	PCBs
	parts per million in whole egg samples, wet weight				
1974	16.59	0.51	1.04	0.26	62.08
1975	23.10	0.38	0.96	0.18	76.24
1977	11.92	0.38	0.33	0.24	55.22
1978	9.64	0.39	0.28	0.12	41.57
1979	6.83	0.60	0.26	0.14	58.74
1980	3.67	0.34	0.13	0.08	25.58
1981	5.74	0.44	0.14	0.12	33.84
1982	6.29	0.39	0.37	0.08	34.74
1983	3.17	0.33	0.15	0.05	21.42
1984	2.94	0.36	0.12	0.05	16.91
1985	3.13	0.32	0.11	0.05	15.89
1986	3.22	0.34	0.11	0.05	14.10
1987	2.52	0.20	0.10	0.04	12.35
1988	2.94	0.34	0.06	0.05	13.43
1989	2.50	0.34	0.07	0.05	15.09
1990	2.64	0.30	0.06	0.03	11.62
1991	3.60	0.27	0.07	0.04	14.09

Year	Lake Michigan				
	DDE	Dieldrin	Mirex	HCB	PCBs
	parts per million in whole egg samples, wet weight				
1976	33.40	0.82	0.36	0.14	118.42
1977	29.25	0.68	0.14	0.24	107.80
1978	22.36	0.87	0.21	0.12	90.74
1980	12.17	0.70	0.10	0.09	57.83
1982	15.86	0.81	0.09	0.09	65.41
1983	6.46	0.61	0.05	0.05	30.27
1984	7.85	0.53	0.09	0.06	31.47
1985	6.98	0.47	0.12	0.05	31.94
1986	7.48	0.38	0.07	0.07	27.25
1987	3.95	0.33	0.06	0.04	16.58
1988	5.04	0.55	0.03	0.04	19.14
1989	4.74	0.54	0.04	0.04	21.00
1990	8.12	0.54	0.06	0.05	32.19
1991	10.52	0.34	0.12	0.05	31.27

continued

Table 77 (continued).—Contaminant levels in herring gull eggs from Great Lakes colonies, 1974-1991.

Year	Lake Huron				
	DDE	Dieldrin	Mirex	HCB	PCBs
	parts per million in whole egg samples, wet weight				
1974	17.40	0.50	1.34	0.38	71.01
1975	14.03	0.36	0.51	0.21	42.67
1977	16.17	0.54	0.44	0.36	70.28
1978	6.53	0.22	0.21	0.11	32.38
1979	2.30	0.30	0.19	0.10	28.66
1980	2.71	0.24	0.11	0.07	20.41
1981	3.82	0.24	0.26	0.07	25.39
1982	4.43	0.28	0.48	0.08	34.29
1983	2.74	0.22	0.15	0.05	18.28
1984	2.56	0.22	0.34	0.07	19.95
1985	2.77	0.30	0.22	0.06	16.90
1986	2.05	0.21	0.12	0.05	12.00
1987	1.32	0.22	0.08	0.02	8.33
1988	1.40	0.22	0.07	0.04	8.83
1989	1.57	0.20	0.09	0.03	10.19
1990	1.86	0.14	0.11	0.03	11.34
1991	1.97	0.16	0.11	0.03	10.01

Year	Lake Erie				
	DDE	Dieldrin	Mirex	HCB	PCBs
	parts per million in whole egg samples, wet weight				
1974	7.13	0.35	0.64	0.29	72.46
1975	7.41	0.33	0.32	0.19	62.30
1977	7.49	0.40	0.45	0.37	68.70
1978	4.29	0.24	0.20	0.09	44.43
1979	3.10	0.25	0.17	0.11	48.44
1980	2.98	0.21	0.18	0.09	46.38
1981	3.90	0.22	0.25	0.09	56.49
1982	3.07	0.25	0.13	0.08	58.89
1983	2.39	0.20	0.17	0.05	37.31
1984	3.23	0.33	0.22	0.06	46.20
1985	2.83	0.19	0.14	0.06	38.41
1986	2.77	0.23	0.14	0.06	33.35
1987	1.77	0.14	0.12	0.03	23.16
1988	2.07	0.17	0.10	0.05	27.50
1989	2.69	0.17	0.18	0.05	39.21
1990	2.01	0.10	0.11	0.03	30.09
1991	2.12	0.08	0.07	0.02	26.55

continued

Table 77 (continued).—Contaminant levels in herring gull eggs from Great Lakes colonies, 1974-1991.

Year	Lake Ontario				
	DDE	Dieldrin	Mirex	HCB	PCBs
	parts per million in whole egg samples, wet weight				
1974	22.30	0.47	6.99	0.58	152.37
1975	22.80	0.29	4.70	0.33	143.11
1977	14.88	0.39	2.48	0.80	102.50
1978	10.65	0.26	1.59	0.32	72.43
1979	8.94	0.21	1.89	0.21	69.60
1980	7.62	0.19	1.65	0.17	56.43
1981	11.00	0.28	2.67	0.24	78.90
1982	10.04	0.28	3.05	0.16	62.90
1983	4.78	0.18	1.43	0.08	42.59
1984	6.26	0.21	1.87	0.12	51.11
1985	6.02	0.15	1.47	0.07	35.58
1986	4.41	0.16	1.10	0.07	27.86
1987	2.60	0.13	0.68	0.04	16.48
1988	4.25	0.15	0.82	0.07	23.53
1989	5.28	0.22	1.15	0.07	32.45
1990	3.36	0.10	0.64	0.03	18.44
1991	3.53	0.14	0.58	0.03	17.06

Source: Environment Canada, Canadian Wildlife Service, Canada Centre for Inland Waters, Organochlorine Contaminant Concentrations in Herring Gull Eggs from Great Lakes Colonies, (Burlington, ON, annual).

Notes: DDE=Derivative of Dichloro-diphenyl-trichloro ethane (DDT). HCB=Hexachloro-benzene. PCBs=Polychlorinated biphenyls. na=not available. Data are not available for: Lake Superior, 1976; Lake Michigan, 1979 and 1981; Lake Huron, 1976; Lake Erie, 1976; and Lake Ontario, 1976.

Related Tables: 31, 54, 76, 80, 82, 83, 94-96, 99, 100.

Table 78.—Duck population estimates, 1955-1992.

Year	Northern pintail	Mallard	Canvasback	Redhead	Gadwall	Green-winged teal	Blue-winged teal	Scaup	American widgeon	Northern shoveler	Total
	millions										
1955	9.39	8.36	0.60	0.57	0.66	1.82	5.38	5.61	3.07	1.57	37.03
1956	9.90	9.84	0.70	0.76	0.78	1.48	4.76	5.73	3.12	1.63	38.70
1957	6.31	9.15	0.61	0.54	0.69	1.05	4.31	5.75	2.85	1.46	32.73
1958	5.55	10.99	0.74	0.44	0.45	1.33	5.16	5.29	2.42	1.19	33.57
1959	5.48	8.75	0.48	0.49	0.53	2.60	5.05	6.96	3.70	1.46	35.50
1960	5.41	7.16	0.60	0.49	0.72	1.39	4.18	4.83	2.94	1.74	29.47
1961	3.68	6.91	0.43	0.32	0.59	1.71	3.66	5.34	2.82	1.26	26.70
1962	3.40	5.14	0.35	0.50	0.85	0.70	2.94	5.24	1.88	1.18	22.18
1963	3.62	6.72	0.50	0.41	1.09	1.16	3.68	5.40	1.71	1.28	25.57
1964	3.01	5.74	0.65	0.53	0.83	1.51	3.96	5.06	2.49	1.61	25.38
1965	3.55	5.10	0.52	0.60	1.27	1.24	3.70	4.65	2.31	1.37	24.31
1966	4.76	6.68	0.66	0.71	1.57	1.58	3.72	4.43	2.28	2.10	28.50
1967	5.27	7.47	0.50	0.73	1.38	1.59	4.51	4.93	2.32	2.29	31.00
1968	3.47	7.02	0.56	0.49	1.95	1.41	3.46	4.36	2.28	1.65	26.64
1969	5.90	7.54	0.50	0.63	1.57	1.47	4.13	5.13	2.92	2.15	31.94
1970	6.37	9.46	0.58	0.62	1.61	2.17	4.86	5.63	3.45	2.22	36.97
1971	5.87	9.31	0.44	0.53	1.60	1.88	4.61	5.06	3.28	2.01	34.60
1972	7.02	9.25	0.43	0.55	1.62	1.89	4.28	7.93	3.17	2.44	38.59
1973	4.35	8.06	0.62	0.50	1.25	1.94	3.33	6.22	2.86	1.62	30.75
1974	6.58	6.68	0.50	0.63	1.59	1.84	4.97	5.72	2.67	2.01	33.19
1975	5.88	7.49	0.59	0.83	1.64	1.67	5.83	6.43	2.69	1.96	35.01
1976	5.48	7.89	0.61	0.67	1.24	1.54	4.75	5.78	2.48	1.76	32.19
1977	3.94	7.40	0.67	0.64	1.31	1.29	4.59	6.25	2.56	1.48	30.11
1978	5.11	7.35	0.37	0.74	1.56	2.19	4.47	5.94	3.29	1.98	32.99
1979	5.38	7.82	0.57	0.69	1.75	2.02	4.86	7.54	3.09	2.39	36.11
1980	4.51	7.57	0.73	0.75	1.39	1.99	4.88	6.31	3.56	1.90	33.61
1981	3.47	6.37	0.61	0.60	1.40	1.85	3.73	5.92	2.92	2.32	29.19
1982	3.71	6.25	0.51	0.62	1.64	1.54	3.66	5.47	2.44	2.14	27.98
1983	3.51	6.31	0.52	0.71	1.52	1.84	3.37	7.14	2.61	1.87	29.38
1984	2.97	5.25	0.52	0.67	1.53	1.36	3.96	6.91	2.99	1.62	27.77
1985	2.51	4.75	0.37	0.58	1.30	1.44	3.46	5.04	2.04	1.70	23.19
1986	2.74	6.84	0.44	0.56	1.54	1.68	4.46	5.20	1.73	2.12	27.31
1987	2.63	5.61	0.45	0.50	1.31	2.00	3.52	4.84	1.98	1.95	24.80
1988	2.01	6.33	0.44	0.44	1.35	2.06	3.98	4.68	2.19	1.68	25.16
1989	2.11	5.65	0.48	0.51	1.42	1.84	3.13	4.34	1.97	1.54	23.00
1990	2.26	5.45	0.54	0.48	1.67	1.79	2.78	4.29	1.86	1.76	22.88
1991	1.80	5.44	0.49	0.45	1.58	1.56	3.76	5.26	2.25	1.72	24.31
1992	2.10	5.98	0.48	0.60	2.03	1.77	4.33	4.64	2.21	1.95	26.09

Source: U.S. Department of the Interior, Fish and Wildlife Service, Office of Migratory Bird Management in conjunction with the Canadian Wildlife Service, Status of Waterfowl and Fall Flight Forecast, (Washington, DC: DOI, annual).

Related Tables: 48, 54, 63, 64, 77, 79-81.

Table 79.—Goose and swan population estimates, 1970-1992.

Year	Canada goose	Snow goose	Greater white-fronted goose	Brant	Tundra swan
	millions			*thousands*	
1970	1.582	0.818	136	142	55
1971	1.628	1.116	168	300	58
1972	1.696	1.413	84	198	63
1973	1.804	1.084	174	166	57
1974	1.795	1.285	201	219	64
1975	1.804	1.167	174	212	67
1976	1.996	1.679	180	249	79
1977	2.318	1.311	255	221	76
1978	2.419	2.072	336	209	70
1979	2.158	1.415	300	173	79
1980	2.159	1.525	377	215	60
1981	2.458	1.524	232	291	93
1982	2.198	1.916	416	227	73
1983	2.490	1.914	355	233	86
1984	2.283	1.593	190	260	81
1985	2.555	2.223	254	291	94
1986	2.706	1.646	373	239	91
1987	2.707	2.080	323	240	94
1988	2.848	1.995	303	270	77
1989	3.097	2.222	377	266	91
1990	2.705	1.994	475	281	91
1991	3.880	2.440	492	275	91
1992	3.571	2.386	418	295	109

Source: U.S. Department of the Interior, Fish and Wildlife Service, Office of Migratory Bird Management in conjunction with the Canadian Wildlife Service, Status of Waterfowl and Fall Flight Forecast, (Washington, DC: DOI, annual).

Notes: Data for Canada goose aggregate population totals for 13 separate populations that nest in North America. Data for snow goose aggregate population totals for Greater snow goose, Lesser snow goose, and Ross' goose populations. Tundra swan estimates include the eastern population only.

Related Tables: 48, 54, 63, 64, 77, 78, 80, 81.

Table 80.—Contaminant levels in waterfowl, by flyway, 1966-1985.

Year	Atlantic flyway			Mississippi flyway		
	DDE	PCBs	Dieldrin	DDE	PCBs	Dieldrin
	parts per million, mean wet weight					
1966	0.70	na	<0.01	0.25	na	<0.01
1969	1.03	1.29	0.05	0.40	0.44	0.04
1972	0.44	1.24	0.02	0.37	0.66	0.02
1976	0.32	0.52	0.06	0.25	0.23	0.05
1979	0.27	0.45	0.05	0.17	0.11	0.05
1982	0.25	0.39	na	0.13	0.14	na
1985	0.09	(a)	(b)	dl	(a)	(a)

Year	Central flyway			Pacific flyway		
	DDE	PCBs	Dieldrin	DDE	PCBs	Dieldrin
	parts per million, mean wet weight					
1966	0.15	na	<0.01	0.65	na	<0.01
1969	0.30	0.20	0.02	0.71	0.20	0.02
1972	0.15	0.10	0.02	0.34	0.11	0.01
1976	0.28	0.15	0.03	0.22	0.16	0.02
1979	0.10	0.06	0.02	0.35	0.07	0.02
1982	0.11	0.05	na	0.36	0.07	na
1985	dl	(a)	(a)	0.05	(a)	(a)

Sources: Cain, B.W., Nationwide residues of organochlorine compounds in wings of adult mallard and black ducks, 1979-80, Pest. Monit. J. 15:128-134 (1981).

Heath, R.G., Nationwide residues of organochlorine compounds in wings of mallards and black ducks, Pest. Monit. J. 3:115-123 (1969).

Heath, R.G. & S.A. Hill, Nationwide organochlorine and mercury residues in wings of adult mallards and black ducks during the 1969-70 hunting season, Pest. Monit. J. 7: 153-164 (1974).

Prouty, R.M. & C.M. Bunck, Nationwide residues of organochlorine compounds in wings of adult mallards and black ducks, 1981-82, Environ. Monit. and Assess. 6:49-57 (1984).

U.S. Fish and Wildlife Service, unpublished data for 1985 samples, Patuxent, MD.

White, D.H., Nationwide residues of organochlorine compounds in wings of adult mallards and black ducks, 1976-77, Pest. Monit. J. 13:12-16 (1979).

White, D.H. & R.H. Heath, Nationwide residues of organochlorine compounds in wings of adult mallards and black ducks, 1972-73, Pest. Monit. J. 9:176-185 (1976).

Notes: DDE=Derivative of Dichloro-diphenyl-trichloro ethane (DDT). PCBs=Polychlorinated biphenyls. (a)=PCBs and dieldrin were detected in 0% of mallard samples and 5% of black duck samples. (b)=Dieldrin was detected in only 18% of mallard samples and 30% of black duck samples. Samples consist of duck wings harvested by hunters. dl=below detection limits.

Related Tables: 31, 54, 76, 77, 82, 83, 95, 96, 99, 100.

Table 81.—Fishing and hunting in the United States, 1955-1991.

Year	Fishermen			Hunters				Total sportsmen
	Freshwater	Saltwater	Total	Small game	Big game	Waterfowl	Total	
	millions							
1955	18.42	4.56	20.813	9.82	4.41	1.99	11.78	24.92
1960	21.68	6.29	25.323	12.11	6.28	1.96	14.64	30.44
1965	23.96	8.31	28.348	10.58	6.57	1.65	13.58	32.88
1970	29.36	9.46	33.158	11.67	7.77	2.89	14.34	36.28
1975	36.60	13.74	41.299	14.18	11.04	4.28	17.09	45.77
1980	35.78	11.97	41.873	12.50	11.05	3.18	16.76	46.97
1985	39.12	12.89	45.345	11.13	12.58	3.20	16.34	49.83
1991	32.39	8.71	34.81	7.57	10.68	2.99	14.00	39.14

Year	Fishing days			Hunting Days				Total sporting days
	Freshwater	Saltwater	Total	Small game	Big game	Waterfowl	Total	
	millions							
1955	338.83	58.62	397.45	118.63	30.83	19.96	169.42	566.87
1960	386.17	80.60	465.77	138.19	39.19	15.16	192.54	658.31
1965	426.92	95.84	522.76	128.45	43.85	13.53	185.82	708.58
1970	592.49	113.69	706.19	124.04	54.54	25.11	203.69	909.88
1975	890.58	167.50	1,050.08	269.65	100.60	31.22	401.48	1,459.55
1980	788.39	164.04	952.42	225.79	117.41	26.18	348.54	1,300.98
1985	895.03	171.06	1,064.99	214.54	135.45	25.93	350.39	1,415.38
1991	434.22	73.76	505.10	76.77	128.08	22.16	234.99	740.09

Source: U.S. Department of the Interior, Fish and Wildlife Service, National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, (Washington, DC: DOI, quinquennial).

U.S. Department of the Interior, Fish and Wildlife Service, 1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: National Overview, (Washington, DC: DOI, September 1992).

Notes: Number of fishermen and hunters includes persons 12 years and older. Detail may not agree with totals because of independent rounding and where sportsman participate in more than one activity.

Related Tables: 12, 33, 78-80, 82, 83.

Table 82.—Contaminant levels in fall run coho salmon from the Great Lakes, 1980-1988.

	Lake Michigan				Lake Erie			
Year	DDT	PCBs	Di-eldrin	Chlor-dane	DDT	PCBs	Di-eldrin	Chlor-dane
	parts per million in skin on fillets							
1980	0.62	1.93	0.06	0.20	0.16	1.07	0.04	0.09
1981	0.53	1.37	na	na	0.11	0.90	na	na
1982	0.27	0.83	0.02	0.08	0.10	0.67	0.02	0.04
1983	0.16	0.30	0.02	0.04	0.09	0.51	0.02	0.03
1984	0.19	0.39	0.01	0.05	0.06	0.38	0.01	0.04
1986	0.15	0.53	0.01	0.07	0.13	0.48	0.02	0.06
1988	0.25	0.06	0.02	0.05	0.10	0.50	0.01	0.05

Source: DeVault, D.S., J.M. Clark, G. Lahois & J. Weishaar. 1988. Contaminants and trends in fall run coho salmon. Journal of Great Lakes Research 14: 23-33.

U.S. Environmental Protection Agency, Great Lakes Program Office, unpublished data, Chicago, IL, November 1991

Notes: DDT=Dichloro-diphenyl-trichloro ethane. PCBs=Polychlorinated biphenyls.na=not available.

Related Tables: 54, 76, 77, 80, 83, 94-96, 99, 100.

Table 83.—Contaminant levels in freshwater fish, 1971-1984.

Year	DDT	PCBs	Toxa-phene	Di-eldrin	Arsenic	Cad-mium	Mer-cury	Lead
	micrograms per gram wet weight, geometric mean concentration							
1971	0.73	1.03	<0.01	0.07	na	na	na	na
1973	0.44	0.78	0.13	0.05	na	na	na	na
1974	0.52	0.95	0.17	0.09	na	na	na	na
1977	0.37	0.87	0.34	0.06	0.27	0.07	0.12	0.28
1979	0.36	0.84	0.28	0.05	0.16	0.04	0.12	0.19
1981	0.3	0.53	0.28	0.04	0.15	0.03	0.12	0.17
1984	0.25	0.39	0.14	0.04	0.14	0.03	0.10	0.11

Source: Schmitt, C.J. & W.G. Brumbaugh, National Contaminant Biomonitoring Program: Concentrations of arsenic, cadmium, copper, lead, mercury, selenium, and zinc in U.S. freshwater fish, 1976-1984, Arch. Environ. Contam. Toxicol. 19:731-747 (1990).

Schmitt, C.J., J.L. Zajicek & P.H. Peterman, National Contaminant Biomonitoring Program: Residues of organochlorine chemicals in U.S. freshwater fish, 1976-1984, Arch. Environ. Contam. Toxicol. 19:748-781 (1990).

Notes: DDT=Dichloro-diphenyl-trichloro ethane and its derivatives. PCBs=Polychlorinated biphenyls. na=not available

Related Tables: 31, 54, 76, 77, 80, 82, 94-96, 99, 100.

Table 84.—Commercial harvest of selected marine and estuarine fisheries, 1950-1991.

Year	Bay scallops	Sea scallops	Oysters	Shrimp	American lobster	Spiny lobster	King salmon	Striped bass
				million pounds				
1950	1.60	19.98	76.41	191.70	23.20	2.49	37.36	na
1951	1.79	18.75	72.99	225.19	25.95	3.92	43.91	na
1952	1.83	18.63	82.24	228.21	25.03	2.42	38.69	na
1953	2.85	23.62	79.72	261.50	28.12	2.75	39.42	na
1954	1.21	17.63	81.92	269.52	27.48	2.85	36.61	na
1955	1.60	22.16	77.52	245.78	28.95	3.15	42.74	na
1956	1.30	20.07	75.13	224.56	26.52	3.85	38.40	na
1957	2.33	20.99	71.65	205.54	30.16	4.69	28.23	na
1958	2.27	18.98	66.40	213.84	27.23	3.59	27.58	na
1959	1.19	24.64	64.71	240.18	29.09	3.69	27.41	na
1960	2.03	26.60	60.01	249.45	31.17	3.20	24.06	na
1961	1.71	27.46	62.30	174.53	28.00	3.22	26.96	na
1962	3.16	24.63	56.04	191.11	29.50	3.66	25.11	na
1963	1.52	19.94	58.44	240.47	30.27	4.17	27.18	na
1964	1.89	16.91	60.53	211.80	30.96	4.08	28.73	na
1965	1.86	20.07	54.69	243.62	30.25	6.23	29.32	7.75
1966	1.78	15.98	51.22	239.04	29.54	5.84	27.22	9.12
1967	1.10	10.24	59.96	307.78	26.75	4.86	26.18	10.05
1968	1.49	12.07	61.89	299.29	32.56	7.47	25.84	11.13
1969	2.11	7.41	52.20	318.53	33.79	8.77	28.03	12.44
1970	1.70	5.85	53.60	367.46	34.15	10.34	31.69	11.19
1971	2.32	5.41	57.94	390.90	33.69	8.94	30.50	7.82
1972	2.03	5.85	56.06	387.46	32.24	12.21	26.86	10.17
1973	1.01	5.29	51.93	379.72	28.99	11.43	35.99	14.78
1974	1.50	6.02	50.18	373.57	28.54	11.07	28.32	11.05
1975	1.65	9.75	53.23	346.73	30.20	7.61	29.77	8.85
1976	1.59	19.59	54.40	406.39	31.48	5.64	30.09	6.54
1977	1.55	25.83	50.09	476.45	31.77	6.60	35.31	5.52
1978	2.07	31.17	54.10	422.88	15.21	5.65	29.78	4.50
1979	1.98	29.65	50.36	335.95	37.20	8.12	33.01	3.49
1980	2.13	28.16	50.83	339.70	37.22	7.03	28.53	4.54
1981	1.42	25.96	52.61	354.47	39.13	6.30	31.07	3.86
1982	2.67	19.94	56.19	283.63	43.08	6.98	34.60	2.17
1983	1.48	19.23	54.05	249.67	44.80	4.80	24.42	1.68
1984	1.48	17.19	54.77	301.35	45.55	6.69	31.71	2.70
1985	1.59	14.96	50.88	333.64	46.95	6.18	27.19	1.20
1986	0.84	19.26	48.77	400.19	45.73	5.43	30.85	0.34
1987	0.50	31.40	39.81	363.14	45.85	6.53	39.93	0.43
1988	0.59	30.30	31.89	330.87	48.64	5.97	45.67	0.41
1989	0.31	33.33	29.25	351.51	52.93	6.85	31.47	0.29
1990	0.54	39.17	29.19	346.49	61.02	7.12	25.75	1.06
1991	0.44	38.37	31.86	320.09	63.34	7.10	20.14	0.73

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Fisheries of the United States, (Washington, DC: DOC, NOAA, NMFS, annual).

Related Tables: 31, 35, 63, 85.

Table 85.—Marine recreational fisheries catch, 1979-1991.

Year	Atlantic and Gulf Coasts		Pacific Coast	
	Number of fish caught	Number of angler trips	Number of fish caught	Number of angler trips
	millions		*millions*	
1979	439	63	49	8
1980	463	74	84	15
1981	331	52	51	11
1982	371	61	53	11
1983	398	69	45	11
1984	356	62	47	10
1985	382	71	43	10
1986	411	62	55	11
1987	288	55	46	10
1988	324	66	51	12
1989	240	48	41	9
1990	231	40	na	na
1991	380	59	na	na

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Fisheries of the United States, 1990, Current Fisheries Statistics, (Washington, DC: DOC, annual).

Notes: na=not available. 1991 data are provisional.

Related Tables: 84.

Table 86.—Status of fisheries, marine mammals, and sea turtles in U.S. waters, 1991.

Fisheries	Utilization status of assessed fisheries				Total assessed
	Unknown	Over	Full	Under	
	number of species				
Northeast demersal	2	15	5	3	25
Northeast pelagic		-	1	5	6
Atlantic anadromous	3	1	1	-	5
Northeast invertebrate	-	2	3	-	5
Atlantic highly migratory pelagic	4	2	3	1	10
Atlantic shark	1	1	-	1	3
Atlantic coastal migratory pelagic	3	3	-	1	7
Atlantic/Gulf/Caribbean reef fish	17	10	1	-	28
Southeast drum and croaker	4	3	-	-	7
Southeast menhaden and butterfish	-	1	2	-	3
Southeast/Caribbean invertebrate	5	8	1	-	14
Pacific coast salmon	-	5	-	-	5
Alaska salmon	-	-	5	-	5
Pacific coast and Alaska pelagic	-	-	4	2	6
Pacific coast groundfish	7	2	7	2	18
Western Pacific invertebrate	-	-	2	0	2
Western Pacific bottomfish*	-	2	-	4	6
Pacific highly migratory pelagic	12	2	1	3	18
Alaska groundfish	1	0	17	5	23
Alaska shellfish	1	0	2	1	4
Nearshore resources	20	10	6	-	36
Total assessed species	80	67	61	28	236
% of total	34	28	25	12	100

Notes: Determinations of fisheries utilization are based on traditional principles of fishery science. Over utilized=more fishing effort is used than is necessary to achieve long-term average catch. Fully utilized=amount of fishing is about equal to effort needed to achieve long-term average catch. Under utilized=when more effort is required to achieve long-term average catch. Demersal=bottom-dwelling fishes such as flounders, skates, and dogfish. Pelagic=mid-water fishes such as blue fish, anchovies, sardines, and squids. Anadromous=fishes which ascend rivers to spawn, such as salmon, shad, and striped bass. Invertebrate fisheries=lobsters, clams, scallops, and shrimp. Highly migratory=high-seas (oceanic) fishes such as tunas, swordfish, and billfishes. Coastal migratory=fishes that range from the shore to the outer edge of the U.S. continental shelf, such as king and Spanish mackeral, dolphin fish, and cobia. Reef fish=fishes that prefer coral reefs, artificial structures, and other hard bottom areas, such as snappers, groupers, and amberjacks. Reef fishes also includes tilefishes that prefer sand bottom areas. *=also includes armorhead.

continued

Table 86 (continued).—Status of fisheries, marine mammals, and sea turtles in U.S. waters, 1991.

Marine mammals, by area	Current abundance *# of individuals*	Status	Trend
N.W. Atlantic			
Fin whale (E)	5,200	Unknown	Unknown
Humpback whale (E)	5,500	Possibly 65% of 1850 abundance	Unknown
Right whale (E)	350	Probably <5% of 1600 abundance	Unknown
Pilot whale	11,200	Unknown	Unknown
Whitesided dolphin	27,600	Unknown	Unknown
Bottlenose (offshore)	7,500	Possibly declined 50% in 1987-88	Unknown
Harbor porpoise	45,000	Unknown	Unknown
Harbor seal	15,000	Unknown	Increasing ?
Mid-Atlantic coastal			
Bottlenose dolphin	560	Possibly declined 50% in 1987-88	Unknown
Gulf of Mexico			
Bottlenose dolphin	14,000	Offshore and coastal	Stable
W. Arctic			
Bowhead whale (E)	7,500	41% of 1848 abundance	Increasing
Pribilof Islands			Stable or
Northern fur seal (D)	1,016,000	<40% of late 1950s abundance	increasing
N. Pacific			
Gray whale	21,113	Recovered, => 1846 abundance	Increasing
Steller sea lion (T)	40,000	22% of late 1950 abundance	Declining
E. Pacific			
Humpback whale (E)	2,000	Probably <15% of 1850 abundance	Unknown
Washington/Oregon			
Harbor porpoise	4,000	Unknown	Unknown
California-Washington			
California sea lion	110,000	Unknown (see note)	Increasing
Harbor seal	20,000	Unknown	Increasing ?
Eastern Tropical Pacific			
N. spotted dolphin	1,515,500	Unknown	Stable
S. spotted dolphin	268,000	Unknown	Increasing
E. spinner dolphin	589,000	Unknown	Stable
Whitebelly sp. dolphin	994,000	Unknown	Stable
N. common dolphin	468,000	Unknown	Stable
C. common dolphin	594,000	Unknown	Stable
S. common dolphin	2,118,000	Unknown	Stable
N. striped dolphin	172,000	Unknown	Stable
S. striped dolphin	1,314,000	Unknown	Stable

continued

Table 86 (continued).—Status of fisheries, marine mammals, and sea turtles in U.S. waters, 1991.

Sea turtles, by area	Historic abundance	Current abundance	Current Trend
		# of nesting females	
Atlantic			
Loggerhead (T)	Unknown	18,000 to 21,000	Stable
Green (T,E**)	Unknown	600 to 800	Increasing
Kemp's ridley (E)	40,000	700	Declining
Leatherback (E)	Unknown	Unknown	Unknown
Hawksbill (E)	Unknown	Unknown	Declining
Pacific			
Loggerhead (T)	Unknown	Unknown	Unknown
Green (T)	10,000	2,200	Increasing
Olive ridley (T)	Unknown	Unknown	Unknown
Leatherback (E)	Unknown	Unknown	Unknown
Hawksbill (E)	Unknown	75	Unknown

Source: Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Our Living Oceans, NOAA Tech. Memo., forthcoming, (Washington, DC: DOC, 1993).

Note: *=abundance estimates range from 1,050-7,500 for offshore N. Atlantic bottlenose dolphin, 17,254-37,946 for Whitesided dolphin, and 1,398-2,040 for E. Pacific Humpback whale. E=Endangered. T=Threatened. D=Depleted. **=endangered in Florida, threatened elsewhere. No significant trend since 1983 for Northern fur seal on St. Paul; declining at 6%/year on St. George. California sea lion status unknown, but believed to be at or above the level of maximum net production. Atlantic Kemp's ridley is declining at an average rate of 3%/year since 1978. Pacific Green turtle historic level for Hawaii only; current level is 2,000 in Hawaii and 100-300 in American Samoa; current level in Guam is unknown. Pacific Hawksbill current abundance in Hawaii; current abundance in Guam and American Samoa is unknown.

Related Tables: 84.

Table 87.—Threatened and endangered U.S. wildlife and plants, 1980-1992.

	Threatened animal groups											
	Mammals	Birds	Reptiles	Amphibians	Fish	Crustaceans	Snails	Insects	Arachnids	Clams	Threatened plants	Total
	number of species											
1980	3	3	10	3	12	0	5	6	0	0	7	49
1981	3	3	8	3	12	0	5	4	0	0	7	45
1982	3	3	8	3	12	1	5	4	0	0	8	47
1983	3	3	12	3	12	1	5	6	0	0	10	55
1984	3	3	8	3	12	1	5	4	0	0	9	48
1985	4	3	8	3	14	1	5	4	0	0	10	52
1986	4	4	11	3	21	1	5	5	0	0	23	51
1987	7	10	18	4	30	1	5	7	0	0	44	126
1988	3	7	14	4	25	1	5	7	0	0	31	125
1989	6	7	14	4	25	1	6	7	0	0	42	112
1990	5	7	13	4	25	1	6	7	0	0	46	111
1991	8	12	18	5	34	2	6	9	0	2	61	157
1992	6	7	14	4	30	2	6	9	0	2	62	142

	Endangered animal groups											
	Mammals	Birds	Reptiles	Amphibians	Fish	Crustaceans	Snails	Insects	Arachnids	Clams	Endangered plants	Total
	number of species											
1980	32	66	13	5	34	1	2	7	0	23	51	234
1981	15	52	7	5	29	1	2	7	0	23	48	189
1982	15	52	8	5	28	2	3	7	0	23	55	198
1983	33	66	14	5	33	2	3	7	0	23	55	243
1984	15	52	8	5	30	3	3	7	0	22	60	205
1985	20	59	8	5	30	3	3	8	0	22	67	225
1986	45	72	12	5	46	3	3	8	0	24	87	222
1987	50	76	15	5	47	7	3	10	3	30	158	404
1988	28	61	8	5	41	5	3	8	0	29	139	397
1989	32	61	9	6	49	8	3	10	3	34	163	378
1990	33	60	8	6	49	8	3	10	3	35	163	370
1991	55	73	16	6	54	8	7	13	3	40	229	511
1992	37	57	8	6	52	8	7	13	3	40	274	505

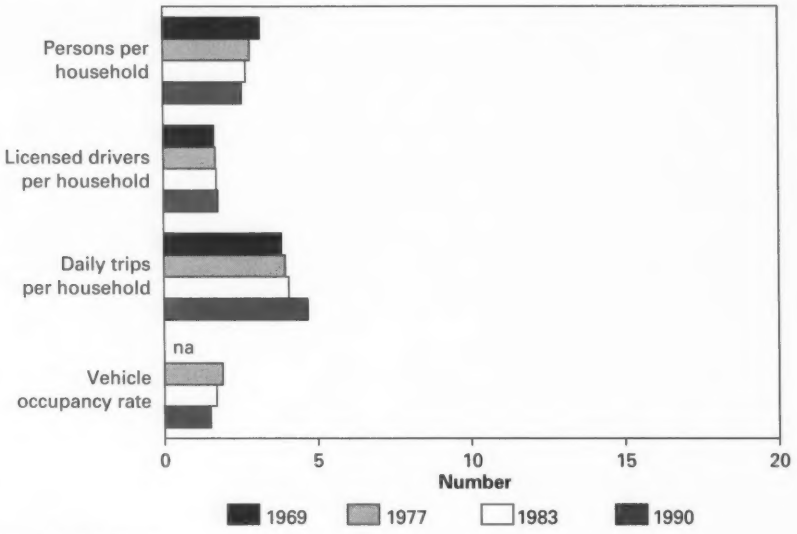
Source: U.S. Department of the Interior, Fish and Wildlife Service, Division of Endangered Species and Habitat Conservation, (Washington, DC: unpublished data).

Notes: Separate populations of a species, listed as Threatened and Endangered are tallied twice. Those species are as follows: grizzly bear; gray wolf; bald eagle; piping plover; roseate tern; green sea turtle; and olive ridley sea turtle. 1992 data are as of September 30, 1992.

Related Tables: 75, 78, 79, 84, 86.

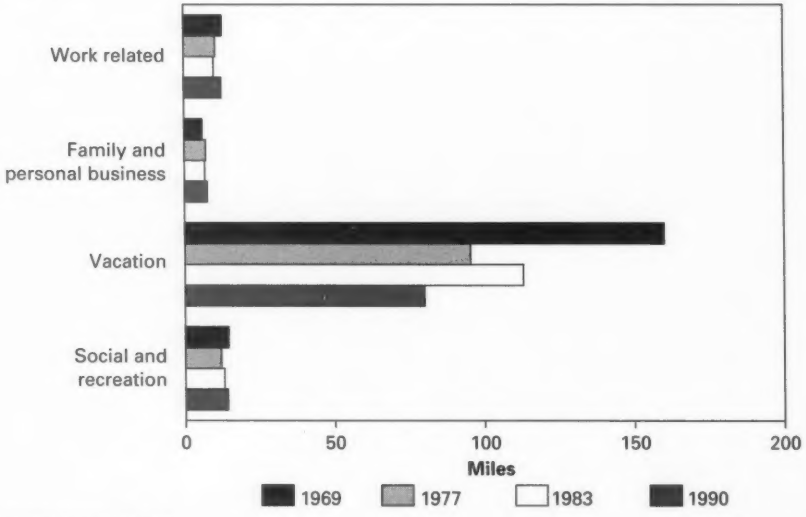
Transportation

Figure 39.—Characteristics of personal travel, 1969, 1977, 1983, and 1990.



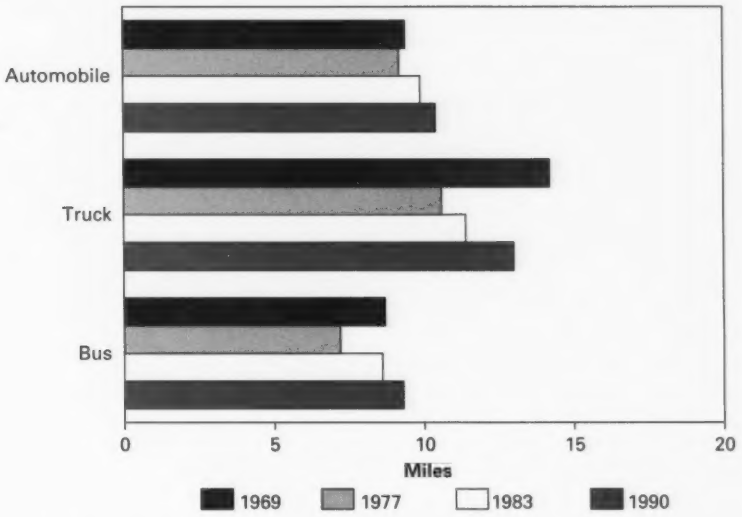
Source: See Table 89.

Figure 40.—Average personal vehicle trip length, 1969, 1977, 1983, and 1990.



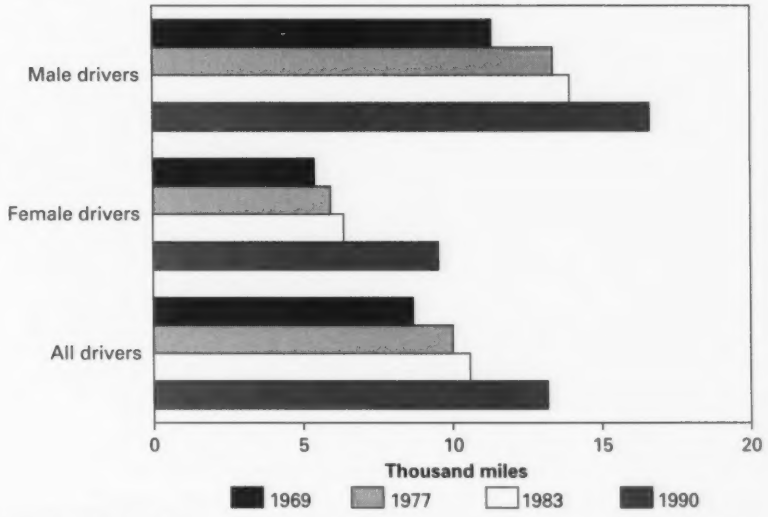
Source: See Table 89.

Figure 41.—Average commute-to-work trip length, by mode, 1969, 1977, 1983, and 1990.



Source: See Table 89.

Figure 42.—Average annual travel per driver, 1969, 1977, 1983, and 1990.



Source: See Table 89.

Table 88.—Personal travel and fuel consumption, 1969-1991.

Year	Total personal passenger vehicle travel	Total automobile fuel consumption	Automobile fuel efficiency
	billion miles	*billion gallons*	*miles traveled per gallon*
1969	971.09	64.80	13.62
1970	916.70	67.82	13.52
1971	966.34	71.35	13.54
1972	1,021.37	76.22	13.40
1973	1,045.00	78.67	13.38
1974	1,007.25	75.08	13.40
1975	1,033.95	76.45	13.50
1976	1,078.22	79.69	13.50
1977	1,109.24	80.40	13.88
1978	1,146.51	81.66	14.00
1979	1,113.64	77.30	14.40
1980	1,111.60	71.88	15.50
1981	1,130.83	70.95	15.90
1982	1,166.26	70.06	16.70
1983	1,198.02	69.91	17.10
1984	1,224.92	68.72	17.80
1985	1,260.57	69.27	18.20
1986	1,310.56	71.40	18.27
1987	1,364.83	70.76	19.20
1988	1,439.55	71.95	19.87
1989	1,495.95	72.33	20.31
1990	1,522.74	72.00	21.02
1991	1,542.85	70.73	21.68

Source: U.S. Department of Transportation, Federal Highway Administration, Highway Statistics, table VM-1, (Washington, DC: DOT, annual).

Note: Personal passenger vehicles include automobiles and motorcycles in use.

Related Tables: 4, 21, 22, 37, 38, 42.

Table 89.—Personal travel, per household, driver, and mode, 1969, 1977, 1983, and 1990.

Characteristics of personal travel	Unit	Year			
		1969	1977	1983	1990
Persons per household	*number*	3.16	2.83	2.69	2.56
Licensed drivers per household	*number*	1.65	1.69	1.72	1.77
Vehicles per household	*number*	1.16	1.59	1.68	1.77
Daily vehicle trips per household	*number*	3.83	3.95	4.07	4.66
Daily vehicle miles per household	*miles*	34.01	32.97	32.16	41.37
Average vehicle occupancy rate	*number*	na	1.90	1.70	1.50
Average vehicle trip length	*miles*	8.89	8.34	7.90	8.87
Work related	*miles*	12.75	10.55	9.95	12.45
Family and personal business	*miles*	6.00	7.13	6.78	7.55
Vacation	*miles*	160.00	95.40	113.00	80.00
Social/recreation	*miles*	14.45	12.00	13.03	14.10
Average travel to work	*miles*	9.90	9.20	9.90	10.60
Automobile	*miles*	9.40	9.20	9.90	10.40
Truck	*miles*	14.20	10.60	11.40	13.00
Bus	*miles*	8.70	7.20	8.60	9.30
Travel to work by auto	%	82.70	80.50	77.50	91.40
By truck	%	8.10	12.50	14.80	*
By public transit	%	8.40	4.70	5.80	5.50
By other means	%	0.80	2.30	1.80	3.10
Annual travel per driver	*1,000 miles*	8.69	10.01	10.59	13.18
Male driver	*1,000 miles*	11.35	13.40	13.96	16.63
Female driver	*1,000 miles*	5.41	5.94	6.38	9.54
Personal travel per mode	*1,000 miles*	7.12	8.82	8.48	9.53
Private vehicle	*1,000 miles*	na	7.59	7.00	8.39
Public vehicle	*1,000 miles*	na	0.24	0.51	0.22
Other	*1,000 miles*	na	0.99	0.98	0.91

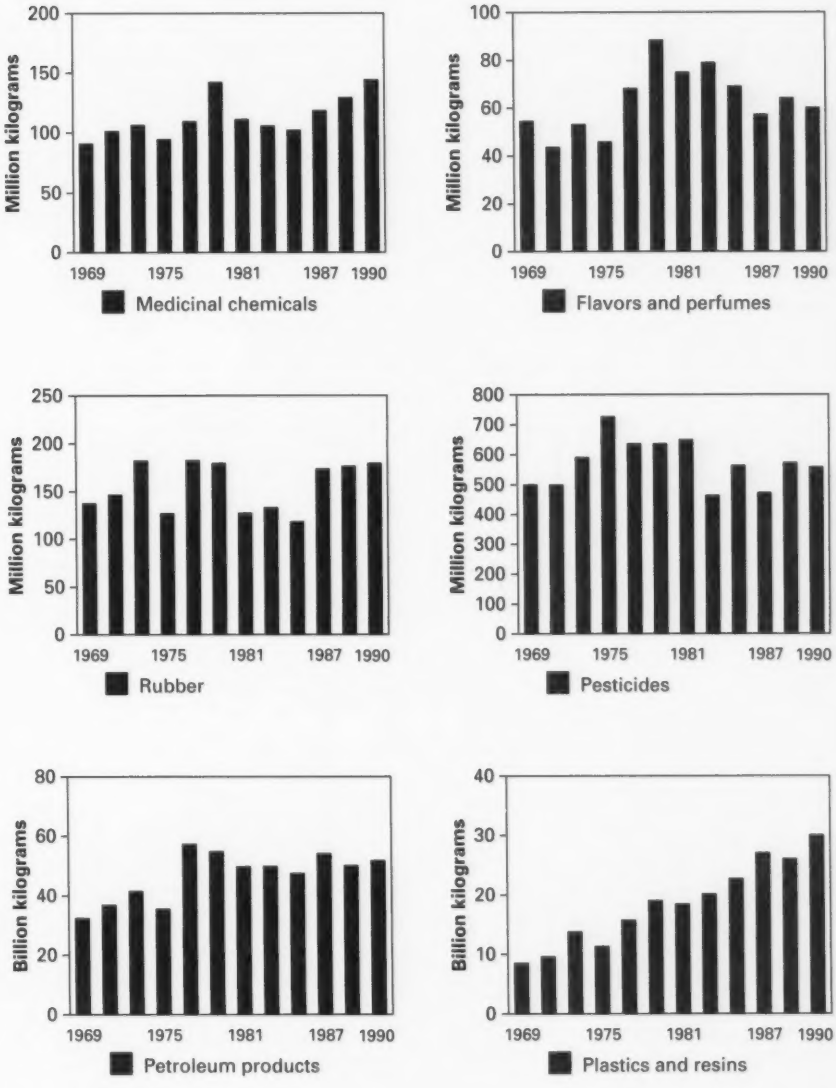
Source: U.S. Department of Transportation, Federal Highway Administration, 1990 Nationwide Personal Transportation Study: Summary of Travel Trends, (Washington, DC: DOT 1992).

Notes: Household vehicles include automobiles, station wagons, and vanbuses/mini-buses, and, except for 1969, light pickups and other light trucks. Household vehicles are those that are owned, leased, rented, or company owned and left at home to be regularly used by household members. They also include vehicles used solely for business purposes or business-owned vehicles if left at home and used for the home-to-work trip; (e.g., taxicabs and police cars). Average vehicle trip length for 1969 is for automobiles only. *=Travel to work in 1990 combines automobiles and trucks. Family and personal business includes vehicle trips to school, church, doctor, shop, etc. Social/recreation includes vehicle trips to visit relatives and friends and other types of pleasure driving. Private vehicle modes of travel include automobile, van, pick-up truck, other truck, camper coach, and motorcycle. Public transportation includes bus, commuter rail, subway, elevated rail, streetcar, and trolley. Other includes airplane, Amtrak, taxi, school bus, moped, bicycle, and, except for 1969, walking.

Related Tables: 3, 4, 6, 37, 38, 88.

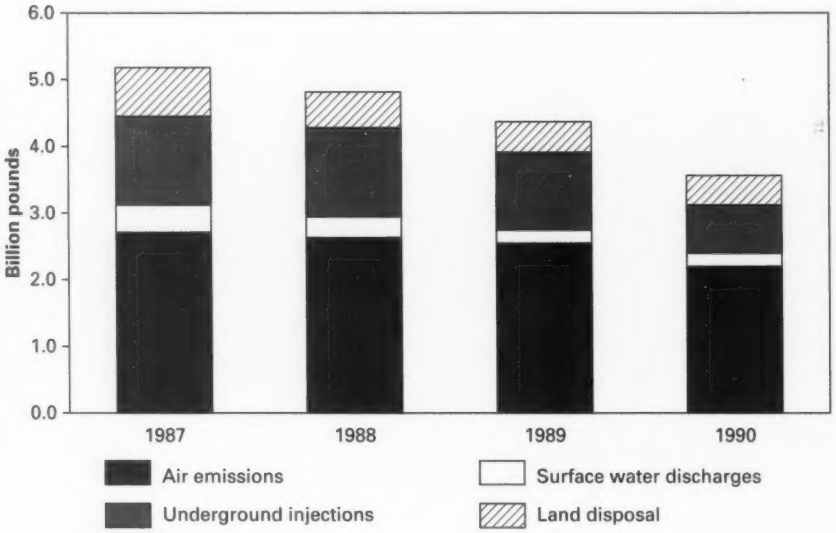
Environmental Hazards and Human Health Hazards

Figure 43.—U.S. production of selected synthetic organic chemicals, 1969-1990.



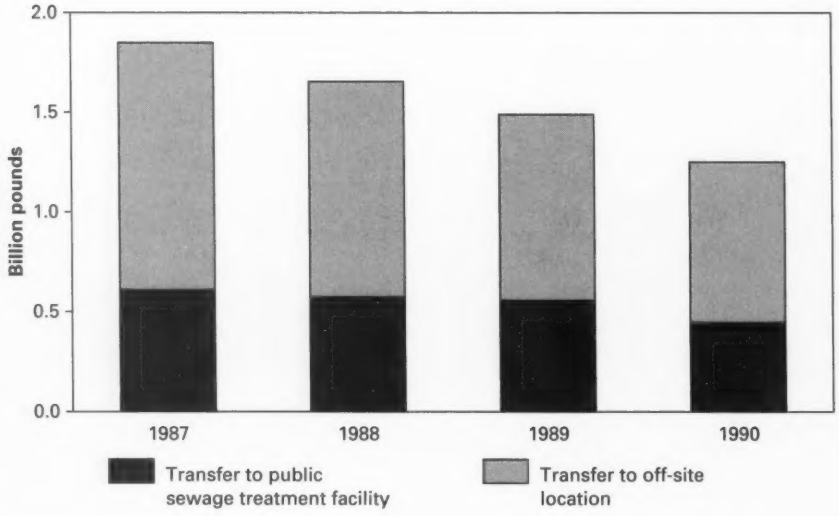
Source: See Table 94.

Figure 44.—Environmental distribution of TRI releases, 1987-1990.



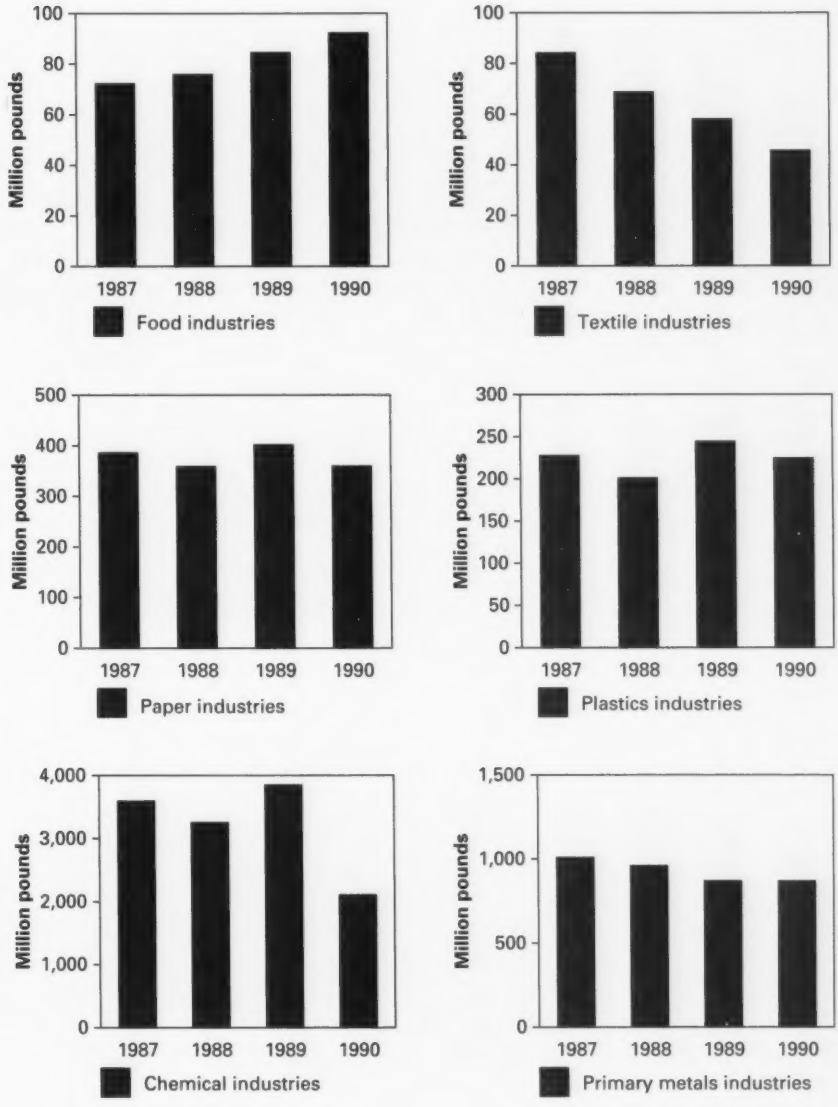
Note: TRI=Toxics Release Inventory.
Source: See Table 95.

Figure 45.—Environmental distribution of TRI transfers, 1987-1990.



Note: TRI=Toxics Release Inventory.
Source: See Table 95.

Figure 46.—TRI releases and transfers by major U.S. industries, 1987-1990.



Note: TRI=Toxics Release Inventory.
Source: See Table 96.

Table 90.—Municipal solid waste, 1960-1990.

Year	Gross discards		Materials recovery		Recovery	Net discards	
	Total	Per capita	Total	Per capita		Total	Per capita
	million tons	*pounds per day*	*million tons*	*pounds per day*	*%*	*million tons*	*pounds per day*
1960	87.8	2.66	5.9	0.18	6.7	81.9	2.48
1965	103.4	2.92	6.8	0.19	6.6	96.6	2.73
1970	121.9	3.27	8.6	0.23	7.1	113.3	3.04
1975	128.1	3.26	9.9	0.25	7.7	118.2	3.01
1980	151.4	3.61	14.5	0.35	9.6	136.9	3.26
1985	164.4	3.70	16.4	0.38	10.0	148.0	3.32
1990	195.7	4.30	33.4	0.70	17.1	162.3	2.90

Source: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Characterization of Municipal Solid Waste in the United States, 1992 Update, (Washington, DC: EPA, 1992).

Notes: Totals may not agree with detail because of independent rounding.

Related Tables: 9, 91.

Table 91.—Municipal solid waste generation and recovery, by waste type, 1960-1990.

Year	Paper		Glass		Metal		Aluminum		Plastics	
	Generation	Recovery	Generation	Recovery	Generation	Recovery	Generation	Recovery	Generation	Recovery
	million tons									
1960	29.9	5.4	6.7	0.1	10.1	0.1	0.4	*	0.4	*
1965	38.0	5.7	8.7	0.1	10.6	0.4	0.5	*	1.4	*
1970	44.2	7.4	12.7	0.2	13.3	0.4	0.8	*	3.1	*
1975	43.0	8.2	13.5	0.4	13.2	0.6	1.1	0.1	4.5	*
1980	54.7	11.9	15.0	0.8	12.7	0.9	1.8	0.3	7.8	*
1985	61.5	13.1	13.2	1.0	11.9	0.6	2.3	0.6	11.6	0.1
1990	73.3	20.9	13.2	2.6	13.5	2.7	2.7	1.0	16.2	0.4

Year	Rubber & Leather		Textiles		Wood		Food		Yard	
	Generation	Recovery	Generation	Recovery	Generation	Recovery	Generation	Recovery	Generation	Recovery
	million tons									
1960	2.0	0.3	1.7	*	3.0	*	12.2	*	20.0	*
1965	2.6	0.3	1.9	*	3.5	*	12.7	*	21.6	*
1970	3.2	0.3	2.0	*	4.0	*	12.8	*	23.2	*
1975	3.9	0.2	2.2	*	4.4	*	13.4	*	25.2	*
1980	4.3	0.1	2.6	*	6.7	*	13.2	*	27.5	*
1985	3.8	0.2	2.8	*	8.2	*	13.2	*	30.0	*
1990	4.6	0.2	5.6	0.2	12.3	0.4	13.2	*	35.0	4.2

Source: U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Characterization of Municipal Solid Waste in the United States, 1992 Update, (Washington, DC: EPA, 1992).

Notes: *=negligible (less than 50, 000 tons or 0.05 percent).

Related Tables: 9, 10, 90.

Table 92.—Accumulated volume and radioactivity of nuclear waste, 1963-1990.

	Low-level wastes at commercial disposal sites				
Year	Volume	Radio-activity	Year	Volume	Radio-activity
	million m3	*million curies*		*million m3*	*million curies*
1963	0.008	0.042	1977	0.514	3.765
1964	0.020	0.204	1978	0.593	4.383
1965	0.034	0.273	1979	0.676	4.539
1966	0.049	0.355	1980	0.768	4.547
1967	0.071	0.428	1981	0.852	4.483
1968	0.091	0.529	1982	0.929	4.568
1969	0.112	0.687	1983	1.007	4.732
1970	0.138	0.855	1984	1.083	4.954
1971	0.169	2.000	1985	1.160	5.282
1972	0.208	2.287	1986	1.213	5.059
1973	0.255	2.732	1987	1.265	4.924
1974	0.309	2.754	1988	1.306	4.793
1975	0.367	3.040	1989	1.352	5.284
1976	0.442	3.268	1990	1.384	5.349

	High-level wastes				
	DOE/defense sites			Commercial sites	
Year	Volume	Radio-activity	Year	Volume	Radio-activity
	million m3	*billion curies*		*thousand m3*	*million curies*
1980	0.30	1.31	1980	2.20	34.20
1981	0.31	1.58	1981	2.20	33.40
1982	0.34	1.32	1982	2.20	32.70
1983	0.35	1.25	1983	2.20	31.90
1984	0.36	1.40	1984	2.20	31.20
1985	0.36	1.47	1985	2.20	30.40
1986	0.36	1.42	1986	2.20	29.70
1987	0.38	1.28	1987	2.20	29.20
1988	0.38	1.18	1988	2.10	28.70
1989	0.38	1.08	1989	2.40	27.90
1990	0.40	1.02	1990	1.20	27.30

Source: U.S. Department of Energy, Integrated Data Base for 1991: Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics, (Washington, DC: DOE, 1991).

Notes: DOE=U.S. Department of Energy. defense=defense-related activities. m3= cubic meters.

Related Tables: 15, 19, 20.

Table 93.—CERCLIS and NPL sites, 1980-1992.

Year	Sites listed		Sites removed
	CERCLIS	NPL	NPL
	number, cumulative		*number*
1980	8,000	na	na
1981	10,500	na	3
1982	13,934	na	na
1983	16,307	545	0
1984	18,836	541	0
1985	22,455	857	0
1986	25,161	887	8
1987	27,507	950	0
1988	29,613	1,174	7
1989	31,522	1,224	9
1990	34,000	1,200	1
1991	35,798	1,185	9
1992	37,598	1,252	6

Source: U.S. Environmental Protection Agency, unpublished data.

Notes: CERCLIS=Comprehensive Environmental Response, Compensation, and Liability Inventory Sites. NPL=National Priorities List. na=not available.

Related Tables: 17, 94, 96.

Table 94.—U.S. production of synthetic organic chemical products, 1969-1990.

Product	Year											
	1969	1971	1973	1975	1977	1979	1981	1983	1985	1987	1989	1990
	billion liters											
Crude coal tar	na	na	na	na	2.24	2.23	1.76	1.07	na	0.72	0.59	0.60
	million kilograms											
Dyes	109	111	129	93	120	121	104	111	101	116	140	117
Organic pigm'ts	28	26	31	23	31	40	34	35	37	43	50	52
Medic'l chem.	91	101	106	94	109	142	111	106	102	118	129	144
Flavor/perfume	54	44	53	46	68	88	75	79	69	57	64	60
Rubber	137	147	182	127	182	179	127	133	118	173	176	179
Plasticizers	635	680	862	635	816	953	862	771	771	907	976	891
Pesticides	499	499	590	726	635	635	649	463	562	472	572	557
	billion kilograms											
Petroleum	32	37	41	35	57	55	50	50	47	54	50	52
Cyclic intermed.	13	14	16	14	8	22	21	20	21	25	25	24
Plastic & resin	8	10	14	11	16	19	18	20	23	27	26	30
Elastomers	2	2	3	2	3	3	2	2	2	2	2	2
Surface ag'ts	2	2	2	2	2	2	2	2	2	3	3	4
Miscellaneous	34	36	45	39	48	55	53	52	53	44	48	50

Source: U.S. International Trade Commission. Synthetic Organic Chemicals, United States Production and Sales, (Washington, DC: ITC, annual).

Notes: Petroleum=Primary products from petroleum and natural gas for chemical conversion. Cyclic intermed.=Cyclic intermediates which are synthetic organic chemicals derived principally from petroleum and natural gas and from coal-tar crudes produced by destructive distillation (pyrolysis) of coal. Most are used in the manufacture of more advanced synthetic organic chemicals and finished products, such as dyes, medicinal chemicals, elastomers (synthetic rubber), pesticides, and plastics.

Related Tables: 15, 17, 18, 21, 52-54, 76, 77, 80, 82, 83, 88, 93, 96, 99, 100.

Table 95.—Environmental distribution of TRI releases and transfers, 1987-1990.

Type of release or transfer	1987	1988	1989	1990
		billion pounds		
Air emissions	2.710	2.630	2.550	2.200
Surface water discharges	0.412	0.311	0.193	0.197
Underground injection	1.330	1.340	1.170	0.725
Land disposal	0.728	0.531	0.454	0.441
Transfer to POTWs	0.610	0.574	0.557	0.447
Transfer to off-site location	1.240	1.080	0.932	0.804
Total releases & transfers	7.030	6.470	5.860	4.810

Source: U.S. Environmental Protection Agency, Office of Toxic Substances, 1990 Toxics Release Inventory: Public Data Release, EPA 700-S-92-002, (Washington, DC: EPA, 1992).

Notes: TRI=Toxics Release Inventory. The major reasons for the reported changes in TRI releases and transfers are discussed in the source report. POTWs=Publicly Owned (Sewage) Treatment Works.

Related Tables: 8-13, 30-32, 76, 77, 80, 82, 83, 93, 96.

Table 96.—Environmental distribution of TRI releases and transfers, by industry, 1987-1990.

Industry	Year	Releases					Transfers		Total releases and transfers
		Fugitive air emissions	Stack air emissions	Surface water discharge	Land disposal	Underground injection	Transfer to public sewage	Transfer to off-site location	
		million lbs							
Food	87	13.75	6.35	3.48	6.56	1.00	36.04	5.09	72.28
	88	15.42	7.05	3.82	5.35	1.07	38.42	4.75	75.89
	89	19.79	8.89	3.16	7.92	1.11	39.28	4.38	84.51
	90	15.27	11.61	5.40	8.69	0.36	42.26	9.11	92.29
Tobacco	87	3.63	3.13	0.04	*	0.00	0.99	0.43	8.22
	88	0.10	1.72	0.01	*	0.00	0.79	0.31	2.94
	89	0.07	1.66	0.45	**	0.00	0.02	0.04	1.83
	90	0.19	2.28	0.02	**	0.00	0.01	0.04	2.55
Textiles	87	12.69	42.62	7.65	0.32	0.00	14.01	6.87	84.16
	88	12.58	36.35	1.05	0.20	*	14.98	3.53	68.69
	89	11.62	29.38	1.00	0.05	0.00	11.18	4.82	58.04
	90	8.59	25.37	0.56	0.04	*	9.98	3.11	45.65
Apparel	87	1.58	1.17	0.04	0.04	0.00	0.12	0.32	3.24
	88	0.33	1.35	**	0.04	0.00	0.47	0.44	2.64
	89	0.47	6.35	*	*	0.00	0.44	0.44	7.71
	90	0.37	1.23	0.05	*	0.00	0.15	0.17	1.97
Lumber	87	7.15	23.36	0.17	0.14	0.00	0.19	4.29	35.10
	88	6.44	28.10	0.27	0.14	0.00	0.26	4.79	39.73
	89	6.03	33.05	0.23	0.11	0.00	0.11	3.47	42.90
	90	6.12	29.88	0.21	0.11	*	0.08	2.93	39.33
Furniture	87	8.57	50.22	0.04	0.04	0.00	0.55	8.41	67.28
	88	8.81	57.17	**	0.08	0.00	0.15	6.27	72.75
	89	9.99	54.08	**	0.02	0.00	0.53	4.81	69.43
	90	7.89	52.16	**	0.08	*	0.34	4.33	64.80
Paper	87	46.86	222.24	63.69	15.56	2.88	52.96	34.83	386.07
	88	45.13	227.85	40.31	11.14	0.00	47.11	34.24	358.67
	89	41.00	230.74	47.99	10.10	*	46.31	31.77	401.90
	90	38.96	204.97	37.68	7.37	*	52.09	18.38	359.45
Printing	87	40.05	23.58	**	*	0.00	2.72	9.35	75.70
	88	35.71	30.03	0.03	0.04	0.04	3.56	11.19	77.04
	89	32.21	26.60	**	0.00	0.00	0.83	7.73	67.38
	90	26.42	25.61	**	0.00	*	0.31	4.38	56.73
Chemicals	87	299.70	684.43	291.51	263.04	1,241.69	370.60	439.95	3,590.93
	88	234.89	624.04	231.74	138.04	1,250.55	347.20	424.21	3,250.66
	89	240.06	580.24	111.24	124.20	1,076.46	359.85	366.24	3,847.29
	90	203.17	491.72	133.47	98.52	658.66	269.14	250.37	2,105.04

continued

Table 96 (continued).—Environmental distribution of TRI releases and transfers, by industry, 1987-1990.

Industry	Year	Releases					Transfers		Total releases and transfers
		Fugitive air emissions	Stack air emissions	Surface water discharge	Land disposal	Underground injection	Transfer to public sewage	Transfer to off-site location	
		million lbs							
Petroleum	87	59.98	28.35	5.65	10.03	29.07	8.31	70.13	221.52
	88	52.16	25.25	3.95	13.13	30.94	11.71	11.36	148.50
	89	41.51	33.44	5.52	4.06	37.58	10.05	8.19	140.34
	90	43.59	27.49	4.99	3.11	37.81	7.71	8.60	133.31
Plastics	87	50.54	131.78	0.41	0.39	0.05	8.49	35.92	227.58
	88	56.01	138.10	0.64	0.27	**	10.96	30.99	200.96
	89	56.83	144.71	0.70	0.25	0.01	12.25	29.61	244.37
	90	64.14	128.37	0.46	0.20	0.02	8.86	22.37	224.42
Leather	87	2.73	12.50	0.54	0.28	0.00	13.97	3.63	33.63
	88	3.96	10.92	0.68	0.35	0.00	10.03	2.83	28.78
	89	3.82	9.49	0.23	0.26	0.00	9.53	3.38	26.71
	90	3.56	8.28	0.39	0.02	0.00	9.62	2.55	24.43
Stone/Clay	87	9.70	20.36	0.71	3.61	6.32	2.61	20.07	63.39
	88	8.81	20.16	1.23	7.24	6.58	2.09	21.79	67.89
	89	7.78	18.33	0.80	4.85	6.57	1.98	17.38	57.67
	90	6.62	15.17	0.17	2.28	7.56	1.77	11.92	45.48
Primary metals	87	67.78	156.52	30.79	414.36	45.94	19.42	274.31	1,009.12
	88	74.74	178.62	20.83	343.43	47.45	23.77	270.05	958.90
	89	71.71	191.98	19.77	297.77	44.40	18.82	225.71	870.16
	90	62.02	159.38	12.08	314.03	20.05	9.51	292.62	869.69
Fabr. metals	87	57.55	80.38	3.11	3.29	1.26	34.30	108.08	287.97
	88	59.42	84.44	1.76	4.30	0.39	22.72	85.77	258.80
	89	61.40	83.55	0.52	1.16	0.34	12.45	82.05	241.46
	90	49.60	80.01	0.41	1.00	*	8.14	66.71	205.89
Machinery	87	27.31	33.33	0.44	0.33	*	3.30	22.98	87.69
	88	28.81	41.59	0.41	0.23	*	3.31	22.10	96.43
	89	28.68	33.66	0.40	0.31	*	3.38	19.78	86.21
	90	21.77	31.00	0.21	0.11	*	2.74	13.01	68.84
Electrical	87	39.66	89.24	1.07	4.58	0.08	22.80	79.31	236.74
	88	38.73	89.31	0.78	1.47	0.04	19.68	47.79	197.80
	89	35.23	70.43	0.50	1.40	0.05	15.61	39.85	163.07
	90	26.91	54.96	0.42	2.74	0.02	12.50	34.98	132.52
Transport.	87	85.17	156.65	0.59	3.05	0.30	8.79	81.31	335.87
	88	87.49	152.82	0.47	2.52	0.08	8.51	65.07	316.97
	89	82.27	147.44	0.18	1.58	*	8.31	47.67	287.45
	90	69.98	123.53	0.23	1.77	*	9.70	39.35	244.57

continued

Table 96 (continued).—Environmental distribution of TRI releases and transfers, by industry, 1987-1990.

Industry	Year	Releases					Transfers		Total releases and transfers
		Fugitive air emissions	Stack air emissions	Surface water discharge	Land disposal	Underground injection	Transfer to public sewage	Transfer to off-site location	
		million lbs							
Meas./	87	21.19	43.50	0.47	0.25	*	5.69	20.94	92.03
Photo.	88	16.70	41.85	0.69	0.49	*	5.15	21.20	86.08
	89	20.23	37.63	0.43	0.11	*	3.67	13.46	75.53
	90	12.75	20.03	0.06	0.01	*	1.82	9.79	44.45
Misc.	87	8.32	20.61	0.21	0.25	*	1.25	11.14	41.82
	88	9.37	23.09	0.09	0.28	*	0.49	9.74	43.07
	89	7.97	19.78	0.04	0.10	*	0.74	14.30	42.91
	90	7.30	17.59	0.02	0.04	*	0.64	6.49	32.07
Non code	87	5.52	9.71	0.96	1.73	0.07	3.08	7.20	28.27
	88	6.85	9.66	1.85	2.55	0.00	2.34	5.51	28.76
	89	5.13	8.11	0.72	0.16	0.00	1.85	7.30	23.28
	90	5.39	9.26	0.53	0.42	1.04	1.89	2.44	20.96
Total	87	869.42	1,840.02	411.58	727.84	1,328.67	610.18	1,244.59	7,032.29
	88	802.47	1,829.47	310.60	531.31	1,337.14	573.96	1,083.90	6,468.86
	89	783.78	1,769.53	193.48	454.39	1,166.52	557.18	932.39	5,857.27
	90	680.62	1,519.94	197.35	440.53	725.20	447.25	803.65	4,814.54

Source: U.S. Environmental Protection Agency, Office of Toxic Substances, 1990 Toxics Release Inventory: Public Data Release, EPA 700-S-92-002, (Washington, DC: EPA, 1992).

Notes: TRI=Toxics Release Inventory. The major reasons for the reported changes in TRI releases and transfers are discussed in the source report. *=less than 1,000 pounds. **=less than 5,000 pounds. Fabr. metals=Fabricated metals. Transport.=Transportation. Meas./Photo.=Measurement & Photography. Misc.=Miscellaneous. Non code=Non 20-39 SIC code.

Related Tables: 8-13, 30-32, 76, 77, 80, 82, 83, 93, 95.

Table 97.—Oil spills in and around U.S. waters, 1970-1990.

Year	Number	Volume	Year	Number	Volume
	thousand spills	*million gallons*		*thousand spills*	*million gallons*
1970	3.71	15.25	1981	9.59	8.92
1971	8.74	8.84	1982	9.42	10.41
1972	9.93	18.81	1983	10.53	8.38
1973	11.05	15.29	1984	10.09	19.01
1974	12.08	15.74	1985	7.75	8.47
1975	11.00	21.53	1986	6.54	4.61
1976	11.07	18.52	1987	6.35	3.88
1977	10.98	8.19	1988	6.79	6.65
1978	12.17	11.04	1989	8.23	13.62
1979	11.56	10.05	1990	7.11	4.26
1980	9.89	12.64			

Source: U.S. Department of Transportation, United States Coast Guard, Polluting Incidents In and Around U.S. Waters, COMDTINST M16450.2H, (Washington, DC: DOT, 1989 with update by agency).

Related Tables: 12, 15, 17, 30, 31, 52, 88, 94.

Table 98.—Waterborne disease outbreaks, by type of water supply system, 1971-1990.

Year	Community	Non-community	Individual	Total	Total cases
			number		
1971	8	8	4	20	5,184
1972	9	19	2	30	1,650
1973	6	16	3	25	1,762
1974	11	9	5	25	8,356
1975	6	16	2	24	10,879
1976	9	23	3	35	5,068
1977	14	18	2	34	3,860
1978	10	19	3	32	11,435
1979	24	13	8	45	9,841
1980	26	20	7	53	20,045
1981	14	18	4	36	4,537
1982	26	15	3	44	3,588
1983	30	9	4	43	21,036
1984	12	5	10	27	1,800
1985	7	14	1	22	1,946
1986	10	10	2	22	1,569
1987	8	6	1	15	22,149
1988	6	8	1	15	2,158
1989	6	5	1	12	2,540
1990	6	7	2	15	1,748

Source: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Waterborne Disease Outbreaks, 1986-1988, Morbidity and Mortality Weekly Report, 39(SS-1):1-13, (Atlanta, GA: HHS, 1990).

U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Waterborne Disease Outbreaks, 1989-1990, Morbidity and MortalityWeekly Report, 40(SS-3):1-22, (Atlanta, GA: HHS, 1991).

Notes: The number of waterborne disease outbreaks reported to the Centers for Disease Control and the Environmental Protection Agency represents a fraction of the total number that occur. Therefore, these data should not be used to draw firm conclusions about the true incidence of waterborne disease outbreaks.

Related Tables: 29-32.

Table 99.—Shellfish-borne disease outbreaks, by etiologic agent, 1973-1987.

Year	Bacterial		Viral		Chemical		Total	
	Out-breaks	Ill-nesses	Out-breaks	Ill-nesses	Out-breaks	Ill-nesses	Out-breaks	Ill-nesses
	number							
1973	1	2	1	285	2	7	4	294
1974	0	0	0	0	2	5	2	5
1975	1	100	0	0	0	0	1	100
1976	0	0	0	0	4	11	4	11
1977	3	27	1	17	0	0	4	44
1978	6	140	1	8	4	10	11	158
1979	6	51	3	36	1	3	10	90
1980	4	12	1	3	5	116	10	131
1981	4	48	0	0	0	0	4	48
1982	4	46	3	8	1	5	8	59
1983	3	74	1	20	0	0	4	94
1984	na	na	na	na	na	na	na	na
1985	1	2	0	0	2	3	3	5
1986	2	23	0	0	1	57	3	80
1987	1	5	0	0	0	0	1	5

Source: Bean, N.H. & P.M. Green, Foodborne Disease Outbreaks in the United States, 1973-1987: Pathogens, Vehicles, and Trends, J. Food Protect., 53(9):804-817, (1990).

Notes: A large precentage (87%) of outbreaks due to shellfish are associated with consumption of shellfish from an unsafe source. The number of foodborne disease outbreaks reported to the Centers for Disease Control represents a fraction of the total number that occur. The likelihood of an outbreak being reported depends on consumer and physician awareness and motivation to report the incident to the local health department as well as on the interest, abilities, and resources of the epidemiologists and laboratorians in the health department. Therefore, these data should not be used to draw firm conclusions about the true incidence of shellfish-borne disease outbreaks.

Related Tables: 30-32, 36.

Table 100.—Pesticide residues in domestic foods, by commodity group, 1978-1991.

Year	Commodity						
	Grains & grain products	Milk, dairy products & eggs	Fish, shellish & meats	Fruits	Vegetables	Other	Total
	% of samples with residues found						
1978	54	43	80	48	34	42	47
1979	54	47	81	58	35	47	49
1980	52	36	71	53	40	36	46
1981	43	32	77	56	37	34	44
1982	42	34	72	49	36	32	41
1983	42	32	61	52	41	31	43
1984	54	31	75	38	33	31	37
1985	52	22	65	36	34	22	35
1986	60	21	68	57	39	48	44
1987	57	24	73	50	37	37	42
1988	49	19	72	51	35	28	40
1989	44	13	65	44	32	20	35
1990	46	9	68	49	38	21	40
1991	42	22	42	51	32	19	36

Source: Food and Drug Administration, Food and Drug Administration Pesticide Program Residues in Foods, J. Assoc. Off. Anal. Chem. vols. 71-74, (1988, 1989, 1990, 1991).

Yess, N.J., M.G. Houston & E.L. Gunderson, Food and Drug Administration Pesticide Monitoring of Foods: 1978-1982, J. Assoc. Off. Anal. Chem. vol. 74:265-272 (1991).

Yess, N.J., M.G. Houston & E.L. Gunderson, Food and Drug Administration Pesticide Monitoring of Foods: 1983-1986, J. Assoc. Off. Anal. Chem. vol. 74:273-280 (1991).

Notes: Domestic samples are collected as close as possible to the point of production. Fresh produce is analyzed as the unwashed whole, raw commodity. Although a percentage of samples contain pesticide residues, the percent of samples with over-tolerance residues (as set by EPA) is low. Between 1973 and 1986; 3 percent of samples were classed as violative; since 1987, less than 1 percent were violative.

Related Tables: 54.

The States

Selected federal environmental activities, by state.

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Alabama	21.9	2.3	927,112	Settlement of a CERCLA suit with the Ciba-Geigy Corp. for violations at a plant in McIntosh. Under a consent decree, Ciba-Geigy will spend $120 million to excavate and remediate soils contaminated with pesticides.
Alaska	11.7	1.3	244,832,654	The largest environmental settlement in U.S. history involved Exxon and Exxon Shipping, who pled guilty to charges stemming from their conduct in conjunction with the Exxon Valdez oil spill in Prince William Sound; criminal and civil penalties totaled $1.125 billion. Reclassification of the Aleutian Canada goose from endangered to threatened. The species, which nests on nine islands in the Alaska Maritime NWR, has increased in population more than 800 percent to over 7,000 since 1975. Identification for acquisition of 23 million acres of inholdings in Alaskan wildlife refuges. Each refuge is developing land-protection plans to identify and rank their natural resources.
Arizona	13.2	2.4	30,905,230	The Arizona Desert Wilderness Act of 1990 protected valuable wildlife habitat, wetlands, desert, and mountains by designating as wilderness 1.3 million acres on four Arizona NWRs: Havasu, Imperial, Kofa, and Cabeza Prieta. Placement of the Glen Canyon Dam under an interim-flow regime to protect environmental, cultural, and recreational resources downstream and in the Grand Canyon. A federal suit against the City of Phoenix for failing to implement and enforce its sewage pretreatment program. The city's two plants serve about 790,000 people and discharge into the Salt River.
Arkansas	12.8	0.5	3,142,114	Establishment of Logan Cave NWR to protect the endangered gray bat and Ozark cavefish. Removal actions stabilized 23 Superfund sites, reducing risk to public health and the environment. PRPs are cleaning 9 of 12

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Arkansas (cont'd)				NPL sites. Overall, 420,000 cubic yards of sludges and soils, 168 million gallons of groundwater, and 60,000 drums of hazardous waste have been removed or stabilized, and 151 acres of land have been returned to safe residential and public use.
California	140.3	15.7	43,272,842	A ban on offshore oil drilling protects 99 percent of the California coast until at least the year 2000. Designation of the Monterey Bay NMS, which, at 5,312 square miles, is the nation's largest. Enactment of the 1992 Reclamation Projects Act, providing water resources for urban and agricultural uses in the western United States, while reserving natural resources for fish and wildlife and habitats. Proposed permanent protection of the Headwaters Redwoods, a 4,500-acre stand of old-growth virgin redwoods, under the America the Beautiful program. Sewage treatment grants of $95 million to improve water quality in Los Angeles and San Diego in 1992, with $95 million requested for 1993. Secondary sewage treatment facilities built with these funds will clean up the beaches of both cities. A $150 million consent decree settlement for cleanup of Stringfellow Acid Pits Superfund site in Glen Avon, one of the largest settlements ever obtained for a private party cleanup at a Superfund site. Over 48 million gallons of groundwater have been treated to date.
Colorado	15.6	2.4	23,432,843	DOE-supported renewable energy conservation-related research of more than $124 million per year, includes $92 million in solar and renewable energy research at the National Renewable Research Laboratory in Golden. One of the largest criminal fines ever levied in an environmental case, with collection of $18.5 million in criminal penalties for five felony and five misdemeanor violations by the Rockwell Corporation at the Rocky Flats Nuclear Weapons Plant near Golden.

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Connecticut	24.0	3.2	8,109	A $13 million settlement with the Dexter Corporation, including $7.2 million for CWA violations—the largest civil penalty ever collected under this statute. Dexter pled guilty to eight felony charges and agreed to remedy violations, implement a new environmental management system, and conduct environmental audits of its other manufacturing sites nationwide. Restoration of fish populations in the Connecticut River through a partnership including FWS, four states, and two utilities. In 1990 the partners agreed to provide safe downstream passage for fish around five hydroelectric projects. In 1991 a total of 196 Atlantic salmon returned and, for the first time in two centuries, a pair of spawning Atlantic salmon were documented in the Connecticut River.
Delaware	9.6	1.0	25,405	Filing of a Superfund complaint and consent decree to clean up the Army Creek Landfill, in New Castle County, at a cost of $25 million. The 18 defendants are required to construct a 60-acre surface cap, a gas venting system, and an onsite groundwater pumping/monitoring system in addition to other cleanup activities. Restoration of inland and coastal wetlands through a cooperative effort between FWS and the Delaware Department of Natural Resources and Environmental Control. A 350-acre coastal wetlands restoration is proposed for an area that provided virtually no usable habitat for wildlife.
Florida	9.6	0.9	4,316,377	A ban on offshore oil exploration near the Florida Keys until at least the year 2000 and a limit on tanker traffic around the keys. Settlement of a federal suit against the state of Florida for polluting water delivered to the Everglades NP and the Loxahatchee NWR. Federal and state officials will take actions to bring the water quality up to state standards by the year 2003. Designation of the Florida Keys NMS. The Bush administration, a citizen's advisory council, and the citizens of the Florida

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Florida (cont'd)				Keys prepared a comprehensive management plan and a water quality protection plan.
Georgia	66.2	1.9	1,379,259	Protection of the threatened loggerhead sea turtle through FWS and COE cooperative efforts to avoid negative impacts to nesting areas on Sea Island. Efforts have yielded a 118-percent increase in nesting by loggerhead turtles. Establishment of the 4,846-acre Bond Swamp NWR in 1989 to protect valuable wildlife and habitat.
Hawaii	33.1	0.4	540,995	Reintroduction of the Hawaiian goose, the nene, to the Kilauea Point NWR. Protection and restoration of wetlands through the James Campbell and the Hamakua acquisition and enhancement projects. FWS contributed over $3 million to these projects in 1991 and 1992.
Idaho	9.6	1.1	32,489,393	Completion of gap analysis for the state. This FWS program maps vegetation and vertebrate distribution, identifying crucial unprotected areas. Environmental cleanup of DOE facilities. During the last three years in Idaho alone, DOE spent over $1.1 billion on environmental restoration research and development, cleanup, and other related activities.
Illinois	88.7	7.2	396,556	Funding of $53 million in 1992 and a request of $62 million in 1993 to implement the Great Lakes Critical Programs Act. The Great Lakes area also implemented the Great Lakes Water Quality Initiative. Provision of clean water for citizens of Rockford through cooperation with state and city governments. Under the emergency response program, approximately 78 homes found to have contaminated wells were connected to the municipal water system.
Indiana	47.2	4.4	210,707	Proposal to establish the Patoka River NWR to protect 20,774 acres, including bottomland hardwood wetlands and related uplands.

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Indiana (cont'd)				Improvement of water quality in the Grand Calumet River through CWA enforcement. In a consent decree, the USX Corporation agreed to pay $9.1 million to clean up contaminated sediments and upgrade wastewater treatment facilities.
Iowa	26.5	1.2	89,647	Establishment of the Walnut Creek NWR in central Iowa to restore native prairie and wetlands habitats for breeding and migratory waterfowl and resident and migratory wildlife. The 100,000-acre refuge lies 15 miles east of Des Moines in Jasper County. Restoration of nearly 4,000 acres of wetlands under a cooperative agreement between FWS and the Iowa Department of Natural Resources.
Kansas	17.7	1.3	166,232	Protection of the Cheyenne Bottoms wetlands and the endangered whooping crane through a joint federal, state, and private effort to designate the area as a wetlands of international importance. Trapping, banding, and monitoring of young eagles and one adult from the first documented nesting bald eagles in the state through cooperative efforts of the state, COE, FWS, and the Rocky Mountain Arsenal.
Kentucky	24.9	2.4	884,364	Protection of federally endangered bats and plants in the Daniel Boone NF through cooperative efforts of COE, FWS, and the Kentucky Department of Fish and Wildlife Resources. Sentencing of the first person ever convicted on felony charges for violation of CERCLA (Superfund) to six months prison and three years probation on December 13, 1989.
Louisiana	21.5	2.0	1,373,813	Designation of the Bayou Cocodrie NWR, and establishment of the Grand Cotie and Bayou Sauvage NWRs to protect and conserve valuable wildlife and habitats. Removal actions stabilized and reduced risk to public health and the environment at 23 Superfund sites. PRPs are cleaning 5 of 12 NPL sites, while construction has been completed at 3 sites. Overall,

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Louisiana (cont'd)				675,000 cubic yards of sludges/soils and 270 million gallons of groundwater have been removed or stabilized and 151 acres of land have been returned to safe residential and public use.
Maine	15.1	1.4	182,598	Settlement of a federal suit against the city of Bangor for CWA violations. The consent decree requires the city to pay a civil penalty, upgrade its wastewater treatment plant, and eliminate untreated wastewater discharges from combined-sewer overflows. Cooperative recovery efforts for the endangered bald eagle and the threatened piping plover. Maine leads the East Coast in piping plover productivity, averaging 2.5 chicks per reproductive pair. A ban on offshore oil drilling protects Maine's coast until at least the year 2000.
Maryland	47.4	3.1	106,836	Improved water quality in the Chesapeake Bay through a joint effort undertaken by EPA and the states of Maryland, Virginia, and Pennsylvania that halved the number of municipal and industrial wastewater dischargers on the EPA list of Significant Non-Compliers. Funding of $243 million in 1992 and proposed funding of $247 million in 1993 for several EPA geographically targeted efforts addressing high human health and ecological risks, including the Chesapeake Bay.
Massachusetts	66.6	4.0	67,892	Coastal City Grants of $25 million in 1990, $100 million in 1992, and a requested grant of $100 million in 1993 for advanced treatment of municipal sewage in Boston. A settlement of $109 million from PRPs for cleanup of the New Bedford Harbor PCB Superfund Site. Funds will cover the cost of cleaning the harbor, restoring or acquiring substitutes for injured resources, and study and investigation costs. Designation of the Stellwagen Bank NMS, 30 nautical miles east of Boston, to protect large populations of fish and marine mammals, including three species of endangered whales.

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Massachusetts (cont'd)				A ban on offshore oil drilling protects the Massachusetts coast until at least the year 2000.
Michigan	84.3	5.0	3,722,507	Completion of three Federal Lead Removal Projects in Michigan: ABC Drum recycling site, where cleanup included thousands of drums; and the Montie Drums and Willow Drums sites, where thousands of buried drums were excavated for proper disposal. Sponsors of a program to recycle materials used in and with automobiles include DOE, the big three U.S. automakers, representatives of the plastics industry, and automobile shredders. A federal suit against the City of Detroit for failing to implement and enforce its sewage pretreatment program. Funding of $53 million in 1992 and a request of $62 million in 1993 to implement the Great Lakes Critical Programs Act. The Great Lakes area also implemented the Great Lakes Water Quality Initiative.
Minnesota	36.0	2.1	3,711,637	Establishment of the Hamden Slough NWR on 5,944 acres in Becker County. The objective is to restore and enhance 3,000 wetland acres, 2,250 upland grass acres, and 500 acres of wildlife supplemental food plots. Establishment of the 2,120-acre Rydell NWR in Polk County to increase waterfowl production for mallards, pintails, wood ducks, redheads, and canvasbacks.
Mississippi	17.6	1.0	1,509,534	Establishment of the Tallahatchie NWR on 15,000 acres in Quitman, Tallahatchie, and Grenada counties to protect both wintering and migrating habitat for Canada geese, mallards, pintail, and blue-winged teal and breeding habitat for wood ducks. Establishment of the Dahomey NWR in Bolivar County to preserve 11,600 acres of valuable wintering habitat for mallards, pintail, blue- and green-winged teal and breeding habitat for wood ducks.

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Missouri	54.4	2.9	1,618,771	Implementation at Times Beach of one of the largest mixed-work Superfund settlements ever. PRPs are bearing most of the potential $120 million cost, including the removal of all contaminated soil and debris, the permitting of an incinerator, and the incineration of up to 100,000 cubic yards of soil. Sentencing of a RCRA violator to two concurrent 2-year prison terms and a $10,000 fine. The president of the Rose Chemical Corp. pled guilty to both counts involving improper disposal of polychlorinated biphenyls (PCBs).
Montana	9.6	1.3	26,279,615	A cooperative Reintroduction and Management Plan to restore the black-footed ferret to the North Central Montana Complex. Implementation of the Montana Wolf Recovery Project to manage wolves that are naturally recolonizing the state. The program focuses on public information and education, monitoring the distribution and number of wolf packs, and control of wolves that hunt livestock.
Nebraska	10.0	0.8	532,915	Establishment of the Palo Alto County WPA and the Hamilton County WPA for the protection and enhancement of waterfowl populations. Conservation and study of biodiversity of the Platte River through partnerships with several organizations. Inventories of plants, animals, clams and other invertebrates, and habitats continue as does restoration of migratory shorebird habitat in the Platte River channel and adjacent wetlands meadows.
Nevada	9.6	1.1	56,945,735	Prosecution and conviction of an executive at Hi-Shear Technology Corporation for the illegal storage and disposal of hazardous waste. He was sentenced to 15 months in prison and a $5,000 fine. Permanent protection of wetlands in western Nevada and conservation of endangered and threatened species through the 1990 Truckee-Carson-Pyramid Lake Settlement Act. The law directs the secretary of the Interior to acquire water

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Nevada (cont'd)				rights to sustain about 25,000 acres of primary wetlands habitat within the Lahontan Valley wetlands. The law also requires recovery plans for the endangered cuiui of Pyramid Lake and the threatened Lahontan cutthroat trout.
New Hampshire	19.6	1.1	732,634	Addition of 1,000 acres of tidal wetlands and adjacent uplands on the former Pease Air Force Base to the Great Bay NWR for the protection and enhancement of wildlife and habitat. Enhancement of the state's endangered bald eagle population. Cooperative initiatives have resulted in enough population growth that FWS has suggested delisting.
New Jersey	80.2	6.0	109,479	Termination of sewage dumping off the New Jersey shore. All municipalities ended their dumping ahead of the stipulated deadline, except for the City of New York, which later completed dumping and paid all fines in accordance with a consent agreement. In Region 2 (NJ, NY, and the Virgin Islands), 71 partners in the EPA Green Lights energy efficiency program volunteered 452.8 million square feet, potentially reducing 1 million pounds of carbon dioxide, sulfur dioxide, and nitrogen oxide. Participation by 45 New Jersey facilities in the EPA 33/50 program reduced 50 percent of program chemicals (from 40.6 million pounds to 16.4 million), exceeding the national goal of an overall reduction of 33 percent by 1992 and 50 percent by 1995.
New Mexico	9.6	1.4	23,051,910	Funding of $57 million in 1992 and requested funding of $139 million in 1993 for the U.S.-Mexico border region as one of several EPA geographically targeted initiatives addressing high human health and ecological risks. Dedication of the Rio Chama WSR below the El Vado Dam. FWS, BLM, and the FS worked together to obtain the designation.

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
New York	216.6	8.7	133,808	Funding for advanced treatment of municipal sewage in New York City through a Coastal City Grant of $70 million in 1992. A grant of $70 million was requested in 1993. Funding of $71 million in 1992 and requested funding of $71 million in 1993 for the Long Island Sound/New York Bight as one of several geographically targeted efforts addressing high human health and ecological risks. Participation of 70 New York facilities in the EPA 33/50 program reduced 50 percent of program chemicals (from 69 million pounds to 35 million), exceeding the national goal of an overall reduction of 33 percent by 1992 and 50 percent by 1995.
North Carolina	35.4	3.5	2,111,098	Protection and restoration of fisheries resources in the Albemarle-Pamlico estuarine system. Efforts made through a partnership involving Coastal America and EPA include installing baffles, annexes, and alternate bypass routes to provide access to historical and present spawning habitats of anadromous fish. Establishment of the Pocosin Lakes NWR and the Roanoake River NWR in 1990 to protect and conserve valuable wildlife habitat.
North Dakota	9.6	0.8	2,593,092	Restoration of fish populations through efforts of the Garrison Dam National Fish Hatchery, with 10 million walleye fingerlings and 2.4 million northern pike fingerlings produced, and 91 million eggs collected, incubated, and shipped. Proposal of the Kraft Slough NWR and the Lonetree Wildlife Area to protect and enhance valuable wildlife and habitat. Acquisition for the refuge is currently underway, as is a management plan for the 33,000-acre wildlife area.
Ohio	110.4	7.2	244,301	Proposal of a 5,000-acre expansion of the Ottawa NWR to protect remnant marshes along Lake Erie. The area is significant to migratory waterfowl and neotropical birds and supports breeding bald eagles.

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Ohio (cont'd)				An agreement with 120 PRPs to clean up the Miami County Incinerator Superfund site. Through this agreement, PRPs will perform and pay for cleanup of contaminated soil and groundwater estimated at $17 million. They also will reimburse EPA for 50 percent of past costs and pay 50 percent of future monitoring costs. In one of the largest CWA civil penalties ever levied, Wheeling-Pittsburgh Steel was assessed a penalty of $6.1 million for violations at three Ohio steel plants. The company is also required to implement an extensive compliance program at its plants.
Oklahoma	15.8	1.4	212,259	Removal actions stabilized and reduced risk to public health and the environment at 18 Superfund sites. Remedial action has been completed at two of ten NPL sites, while construction is underway at three more. PRPs are taking over cleanup at five of the NPL sites. Overall, 740,000 cubic yards of sludges and soils and 296 million gallons of groundwater have been removed or stabilized, and 266 acres of land have been returned to safe residential and public use. Restoration and improvement of 3,000 acres of wetlands and 8,000 acres of uplands through 30 cooperative agreements involving FWS in the states of OK, TX, and NM.
Oregon	22.1	2.2	32,395,023	Establishment of the Nestucca Bay NWR and the Siletz Bay National NWR to protect and enhance valuable habitats and wildlife. FWS entered into cooperative agreements with over 20 private landowners resulting in the restoration of 1,400 acres of wetlands. A ban on offshore oil drilling protects Oregon's coast until at least the year 2000.
Pennsylvania	77.7	8.4	631,841	A $124.5 million settlement for the cleanup of the Whitmoyer Labs Superfund site, a $21.4 million settlement for the cleanup of the Osborn Landfill site, and a $20 million

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Pennsylvania (cont'd)				settlement for the cleanup of the Tyson's Dump #1 site. PRPs will perform all work at these sites. Cleanup and removal from the NPL of five Superfund sites: Lansdowne Radiation, Presque Isle, Taylor Borough Dump, Voortman Farm, and ABM-Wade. Enactment of the Great Lakes Fish and Wildlife Restoration Act which provides for the assessment of management and restoration needs of fishery resources in the Great Lakes.
Rhode Island	13.1	1.1	1,497	Restoration of 130 acres of salt marsh by opening culverts to restore tidal flooding at the Galilee Bird Sanctuary in Narragansett. Coastal America is contributing 40 percent of the funding. Establishment of the Pettaquamscutt NWR to protect and restore valuable habitats and wildlife.
South Carolina	20.1	1.6	811,323	Protection of wildlife and habitat at the Savannah River Site which serves as a refuge for five endangered species: bald eagles, peregrine falcons, wood storks, red-cockaded woodpeckers, and shortnose sturgeons. Establishment of the ACE Basin NWR to protect and enhance valuable habitat and wildlife. The refuge is part of the ACE Basin Project, a multi-agency plan to conserve and enhance 350,000 acres of the ACE Basin.
South Dakota	9.6	0.9	3,260,188	Restoration of fish populations by releasing 17,000 paddlefish into Lewis and Clark Lake. After a year of study, the process was repeated with 25,000 fish released into Lewis and Clark Lake, and 21,000 released into Lake Francis Case. Acquisition of 13 perpetual grassland easements covering 9,100 acres to protect important wetlands complexes from agricultural chemicals and siltation. The easements also provide nesting habitat for migratory birds.

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Tennessee	28.5	3.0	1,473,083	A 14-count indictment against the Recticel Foam Corporation in Greenville for the illegal treatment, storage, and disposal of hazardous wastes. Each of the seven defendants, including the president and two plant managers, face potential penalties of 25-40 years of imprisonment and/or $750,000-$7.5 million in fines. Reintroduction of the endangered smoky madtom to historic habitat within the Great Smoky NP. FWS collected these fish from their only known location, near the Little Tennessee River, reared them in a laboratory, and reintroduced 135 into another stream within the park, thus establishing a second population.
Texas	89.7	6.6	2,390,966	Acquisition of 11,500 acres of Matagorda Island to complete acquisition of the entire barrier island. A comprehensive management plan with private partners has been proposed for 56,668 acres of the island. Protection of the endangered whooping crane by preventing the erosion of 75-100 acres of valuable salt marsh habitat. This habitat, located in the Aransas NWR is used by 20 of the 142 whooping cranes left in the world. Enforcement of environmental laws for the improvement of wastewater treatment in the city of Houston. In 1989, the city agreed to spend $800 million by 1997 to study and develop systems to eliminate wetweather bypasses and overflows of wastewater. The new systems will greatly reduce pollutants to Galveston Bay. Funding of $57 million in 1992 and requested funding of $139 million in 1993 for the U.S.-Mexico border region as one of several EPA geographically targeted initiatives addressing high human health and ecological risks.
Utah	10.3	2.1	32,251,995	Cleanup of the Bingham Creek Superfund site in southwest Salt Lake City. Excavation of 72,240 cubic yards of contaminated soil was completed within five months.

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
Utah (cont'd)				Protection of 7 listed and 38 candidate species through the Desert Tortoise Habitat Conservation Plan. The resolution could include a 55-square-mile management complex for the tortoise.
Vermont	9.6	0.7	354,411	Restoration of fish populations in Lake Champlain through production of Atlantic salmon and lake trout and through a lamprey-control cooperative program involving state agencies and Canada. Protection for endangered and threatened plants through the signing of an ESA cooperative agreement between the state and FWS.
Virginia	40.1	3.1	2,101,439	Establishment of the James River NWR on 3,538 acres of upland eagle habitat, adjacent to the James River, for the protection and conservation of valuable wildlife and habitat. Restoration of populations of endangered bald eagles. Through FWS cooperative efforts to protect nesting habitat and restrict the use of granular carbofuran, the eagles have sustained a successful reproductive rate.
Washington	34.1	3.8	11,621,439	Coastal City Grants of $35 million in 1992 and requested grants of $35 million in 1993 for advanced treatment of municipal sewage in Seattle. Proposal of the Olympic Coast NMS and the Northwest Straits NMS to protect 5,428 miles of habitat for endangered species including bald eagles, perergine falcons, sea otters, and gray, blue, and humpback whales. A ban on offshore oil drilling protects Washington's coast until at least the year 2000.
West Virginia	30.5	1.5	1,105,124	Proposal of the Ohio River Islands NWR to protect and enhance valuable wildlife and habitat. Located in Parkersburg, the refuge also includes islands in Pennsylvania, Ohio, and Kentucky. The Canaan Valley Task Force, a partnership of local, state, and federal agencies, environmental organizations,

Selected federal environmental activities, by state (continued).

State	1992 federal funding SRF/CWA	CAA*	Federal lands**	Highlights 1989-1992
	million $		*acres*	
West Virginia (cont'd)				and local businesses and landowners, chaired by FWS, collaborates to protect the Canaan Valley's 7,000 acres of wetlands.
Wisconsin	53.0	3.2	2,036,867	Dedication of the 31,904-acre Horicon Marsh as a wetland of international importance. This marsh, one of the largest intact freshwater marshes in the United States, contains valuable waterfowl habitat. Design of 15 environmental management programs totaling $27.8 million to rehabilitate and enhance fishery habitats. Three projects, Bertom Lake, Lake Onalaska, and Blackhawk Park, totalling $4.9 million, have been completed.
Wyoming	9.6	0.8	30,131,283	Reintroduction of 49 endangered black-footed ferrets to the wild sagebrush-grasslands of Shirley Basin, between Casper and Laramie. Found nowhere else in the world, this species has grown in population from only 18 to 322, assisted by a partnership between the state and FWS. Creation of over 1,000 acres of wetlands on the Seedskadee NWR, creation of trout habitat, and protection of eroding riverbanks through installation of rock sills that restore ditch flows.

Selected federal environmental activities, by state (continued).

Note: Abbreviations used in the table include the following:

BLM	=	Bureau of Land Management, U.S. Department of the Interior.
CAA	=	Clean Air Act.
CERCLA	=	Comprehensive Emergency Response, Compensation, and Liability Act (Superfund).
COE	=	U.S. Army Corps of Engineers.
CWA	=	Clean Water Act
DOC	=	U.S. Department of Commerce.
DOE	=	U.S. Department of Energy.
DOI	=	U.S. Department of the Interior.
EPA	=	U.S. Environmental Protection Agency.
ESA	=	Endangered Species Act.
FS	=	USDA Forest Service.
FWS	=	Fish and Wildlife Service, U.S. Department of the Interior.
NF	=	National Forest administered by USDA Forest Service as part of the National Forest System.
NP	=	National Park administered as part of the National Park System by the National Park Service, U.S. Department of the Interior.
NPL	=	National Priority List of nation's most seriously contaminated sites.
NMS	=	National Marine Sanctuary administered by U.S. Department of Commerce, NOAA National Ocean Service.
NWR	=	National Wildlife Refuge.
PRP	=	Potentially responsible party for cleanup of a Superfund site.
SRF	=	State Revolving Fund.
TVA	=	Tennessee Valley Authority.
USDA	=	U.S. Department of Agriculture.
WPA	=	Waterfowl Production Area.
WSR	=	Wild and Scenic River administered as part of the National Wild and Scenic River System.

*Estimated total funding for 1992.

**Federal lands listed here include:

DOC national marine sanctuaries.

DOI lands—BLM; national parks; wild, scenic, and recreational rivers; areas in the National Wilderness Preservation System; and acreage reflecting 1992 FWS estimates for NWRs, WPAs, and coordination areas.

TVA lands—fee-owned property, above full-pool elevations, not including power-generation facilities.

USDA lands—national forests, purchase units, national grasslands, research and experimental areas, and other specially designated areas in the National Forest System.

Source: Executive Office of the President, Office of Management and Budget; U.S. Department of the Interior, U.S. Fish and Wildlife Service; U.S. Department of Energy, Office of Environmental Guidance; Tennessee Valley Authority; U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response; *Public Land Statistics 1991*, Bureau of Land Management, September 1992; DOI, Division of Realty; BLM, Branch of Wilderness Resources; BLM, Branch of Recreation and Cultural Resources; National Park Service; *Land Areas of the National Forest System As of September 30, 1991*, U.S. Department of Agriculture, Forest Service, 1992; *Fish & Wildlife '91, A Report to the Nation*, DOI, FWS, 1992.

Appendix

The National Environmental Policy Act of 1969

(as Amended [1])

An Act to establish a national policy for the environment, to provide for the establishment of a Council on Environmental Quality, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "National Environmental Policy Act of 1969."

Purpose

Sec. 2. The purposes of this Act are: To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality.

TITLE I
Declaration of National Environmental Policy

Sec. 101. (a) The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

(b) In order to carry out the policy set forth in this Act, it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may—

(1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

(2) assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;

[1] Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, 4(b), Sept. 13, 1982.

(3) attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;

(4) preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice;

(5) achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities; and

(6) enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

(c) The Congress recognizes that each person should enjoy a healthful environment and that each person has a responsibility to contribute to the preservation and enhancement of the environment.

Sec. 102. The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall—

(A) Utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decisionmaking which may have an impact on man's environment;

(B) Identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations;

(C) Include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on—

(i) The environmental impact of the proposed action,

(ii) Any adverse environmental effects which cannot be avoided should the proposal be implemented,

(iii) Alternatives to the proposed action,

(iv) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and

(v) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Prior to making any detailed statement, the responsible Federal official shall consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved. Copies of such statement and the comments and views of the appropriate Federal, State, and local agencies, which are authorized to develop and enforce environmental standards, shall be made available to the President, the Council on Environmental Quality and to the public as provided by section 552 of title 5, United States Code, and shall accompany the proposal through the existing agency review processes;

(D) Any detailed statement required under subparagraph (c) after January 1, 1970, for any major Federal action funded under a program of grants to States shall not be deemed to be legally insufficient solely by reason of having been prepared by a State agency or official, if:

(i) the State agency or official has statewide jurisdiction and has the responsibility for such action,

(ii) the responsible Federal official furnishes guidance and participates in such preparation,

(iii) the responsible Federal official independently evaluates such statement prior to its approval and adoption, and

(iv) after January 1, 1976, the responsible Federal official provides early notification to, and solicits the views of, any other State or any Federal land management entity of any action or any alternative thereto which may have significant impacts upon such State or affected Federal land management entity and, if there is any disagreement on such impacts, prepares a written assessment of such impacts and views for incorporation into such detailed statement.

The procedures in this subparagraph shall not relieve the Federal official of his responsibilities for the scope, objectivity, and content of the entire statement or of any other responsibility under this Act; and further, this subparagraph does not affect the legal sufficiency of statements prepared by State agencies with less than statewide jurisdiction.

(E) Study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources;

(F) Recognize the worldwide and long-range character of environmental problems and, where consistent with the foreign policy of the United States, lend appropriate support to initiatives, resolutions, and programs designed to maximize international cooperation in anticipating and preventing a decline in the quality of mankind's world environment;

(G) Make available to States, counties, municipalities, institutions, and individuals, advice and information useful in restoring, maintaining, and enhancing the quality of the environment;

(H) Initiate and utilize ecological information in the planning and development of resource-oriented projects; and

(I) Assist the Council on Environmental Quality established by title II of this Act.

Sec. 103. All agencies of the Federal Government shall review their present statutory authority, administrative regulations, and current policies and procedures for the purpose of determining whether there are any deficiencies or inconsistencies therein which prohibit full compliance with the purposes and provisions of this Act and shall propose to the President not later than July 1, 1971, such measures as may be necessary to bring their authority and policies into conformity with the intent, purposes, and procedures set forth in this Act.

Sec. 104. Nothing in section 102 or 103 shall in any way affect the specific statutory obligations of any Federal agency (1) to comply with criteria or standards of environmental quality, (2) to coordinate or consult with any other Federal or State agency, or (3) to act, or refrain from acting contingent upon the recommendations or certification of any other Federal or State agency.

Sec. 105. The policies and goals set forth in this Act are supplementary to those set forth in existing authorizations of Federal agencies.

TITLE II
Council on Environmental Quality

Sec. 201. The President shall transmit to the Congress annually beginning July 1, 1970, an Environmental Quality Report (hereinafter referred to as the "report") which shall set forth (1) the status and condition of the major natural, manmade, or altered environmental classes of the Nation, including, but not limited to, the air, the aquatic, including marine, estuarine, and fresh water, and the terrestrial environment, including, but not limited to, the forest, dryland, wetland, range, urban, suburban and rural environment; (2) current and foreseeable trends in the quality, management and utilization of such environments and the effects of those trends on the social, economic, and other requirements of the Nation; (3) the adequacy of available natural resources for fulfilling human and economic requirements of the Nation in the light of expected population pressures; (4) a review of the programs and activities (including regulatory activities) of the Federal Government, the State and local governments, and nongovernmental entities or individuals with particular reference to their effect on the environment and on the conservation, development and utilization of natural resources; and (5) a program for remedying the deficiencies of existing programs and activities, together with recommendations for legislation.

Sec. 202. There is created in the Executive Office of the President a Council on Environmental Quality (hereinafter referred to as the "Council"). The Council shall be composed of three members who shall be appointed by the President to serve at his pleasure, by and with the advice and consent of the Senate. The President shall designate one of the members of the Council to serve as Chairman. Each member shall be a person who, as a result of his training, experience, and attainments, is exceptionally well qualified to analyze and interpret environmental trends and information of all kinds; to appraise programs and activities of the Federal Government in the light of the policy set forth in title I of this Act; to be conscious of

and responsive to the scientific, economic, social, esthetic, and cultural needs and interests of the Nation; and to formulate and recommend national policies to promote the improvement of the quality of the environment.

Sec. 203. (a) The Council may employ such officers and employees as may be necessary to carry out its functions under this Act. In addition, the Council may employ and fix the compensation of such experts and consultants as may be necessary for the carrying out of its functions under this Act, in accordance with section 3109 of title 5, United States Code (but without regard to the last sentence thereof).

(b) Notwithstanding section 1342 of Title 31, the Council may accept and employ voluntary and uncompensated services in furtherance of the purposes of the Council.

Sec. 204. It shall be the duty and function of the Council—

(1) to assist and advise the President in the preparation of the Environmental Quality Report required by section 201 of this title;

(2) to gather timely and authoritative information concerning the conditions and trends in the quality of the environment both current and prospective, to analyze and interpret such information for the purpose of determining whether such conditions and trends are interfering, or are likely to interfere, with the achievement of the policy set forth in title I of this Act, and to compile and submit to the President studies relating to such conditions and trends;

(3) to review and appraise the various programs and activities of the Federal Government in the light of the policy set forth in title I of this Act for the purpose of determining the extent to which such programs and activities are contributing to the achievement of such policy, and to make recommendations to the President with respect thereto;

(4) to develop and recommend to the President national policies to foster and promote the improvement of environmental quality to meet the conservation, social, economic, health, and other requirements and goals of the Nation;

(5) to conduct investigations, studies, surveys, research, and analyses relating to ecological systems and environmental quality;

(6) to document and define changes in the natural environment, including the plant and animal systems, and to accumulate necessary data and other information for a continuing analysis of these changes or trends and an interpretation of their underlying causes;

(7) to report at least once each year to the President on the state and condition of the environment; and

(8) to make and furnish such studies, reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

Sec. 205. In exercising its powers, functions, and duties under this Act, the Council shall—

(1) Consult with the Citizens' Advisory Committee on Environmental Quality established by Executive Order No. 11472, dated May 29, 1969, and with such representatives of science, industry, agriculture, labor, conservation organizations, State and local governments and other groups, as it deems advisable; and

(2) Utilize, to the fullest extent possible, the services, facilities and information (including statistical information) of public and private agencies and organizations, and individuals, in order that duplication of effort and expense may be avoided, thus assuring that the Council's activities will not unnecessarily overlap or conflict with similar activities authorized by law and performed by established agencies.

Sec. 206. Members of the Council shall serve full time and the Chairman of the Council shall be compensated at the rate provided for Level II of the Executive Schedule Pay Rates (5 U.S.C. 5313). The other members of the Council shall be compensated at the rate provided for Level IV of the Executive Schedule Pay Rates (5 U.S.C. 5315).

Sec. 207. The Council may accept reimbursements from any private nonprofit organization or from any department, agency, or instrumentality of the Federal Government, any State, or local government, for the reasonable travel expenses incurred by an officer or employee of the Council in connection with his attendance at any conference, seminar, or similar meeting conducted for the benefit of the Council.

Sec. 208. The Council may make expenditures in support of its international activities, including expenditures for: (1) international travel; (2) activities in implementation of international agreements; and (3) the support of international exchange programs in the United States and in foreign countries.

Sec. 209. There are authorized to be appropriated to carry out the provisions of this chapter not to exceed $300,000 for fiscal year 1970, $700,000 for fiscal year 1971, and $1,000,000 for each fiscal year thereafter.

Federal Documents for Further Reading

Council on Environmental Quality, *Environmental Trends*, (Washington, DC: U.S. Government Printing Office, 1989).

Council on Environmental Quality, *Environmental Quality: 20th Annual Report of the Council on Environmental Quality*, (Washington, DC: U.S. Government Printing Office, 1990).

Council on Environmental Quality, *Environmental Quality: 21st Annual Report of the Council on Environmental Quality*, (Washington, DC: U.S. Government Printing Office, 1991).

Council on Environmental Quality, *Environmental Quality: 22nd Annual Report of the Council on Environmental Quality*, (Washington, DC: U.S. Government Printing Office, 1992).

Executive Office of the President, *United States of America National Report*, prepared for UNCED, (Washington, DC: U.S. Government Printing Office, June 1992).

National Acidic Precipitation Assessment Program, *Mission, Goals, and Program Plan, Post 1990*, Draft, (Washington, DC: NAPAP, 1991).

National Acidic Precipitation Assessment Program, *Acidic Deposition: State of Science and Technology, Summary Report*, (Washington, DC: NAPAP, 1991).

National Acidic Precipitation Assessment Program, *NAPAP Integrated Assessment*, (Washington, DC: NAPAP, 1991).

President's Commission on Environmental Quality, *Energy Efficiency Resource Directory: A Guide to Utility Programs*, (Washington, DC: PCEQ, 1992).

President's Commission on Environmental Quality, *Partnerships to Progress*, (Washington, DC: PCEQ, 1992).

President's Commission on Environmental Quality, *Total Quality Management: A Framework for Pollution Prevention*, (Washington, DC: PCEQ, 1992).

Radian Corp. for U.S. Environmental Protection Agency, *Feasibility and Cost Effectiveness of Controlling Emissions from Diesel Engines in Rail, Marine, Construction, Farm, and Other Mobile Off-Highway Equipment*, (Washington, DC: EPA, February 1988).

Shaver, Christine, and Darwin Morse, *Air Quality in the National Parks*, (Washington, DC: U.S. Department of the Interior, National Park Service, 1988).

United Nations Conference on Environment and Development Secretary General, *Conservation and Development of Forests*, (New York, NY: United Nations, 1992).

U.S. Department of Agriculture, Forest Service, *Silvics of North America*, 2 vol., Agriculture Handbook 654, update of 1965 edition, (Washington, DC: U.S. Government Printing Office, 1992).

U.S. Department of Agriculture, Forest Service, *An Interim Guide to Conservation and Management of Pacific Yew (Draft)*, (Washington, DC: USDA Forest Service, 1992).

U.S. Department of Commerce, NOAA National Marine Fisheries Service, *Our Living Oceans: The First Annual Report on the Status of U.S. Living Marine Resources*, (Washington, DC: DOC/NOAA/NMFS, 1991).

U.S. Department of Energy, *National Energy Strategy: Powerful Ideas for America*, First Edition 1991/1992, (Washington, DC: DOE/DP-0083, January 1992).

U.S. Department of Energy, *Limiting Net Greenhouse Gas Emissions in the United States*. (Washington, DC: DOE/PE/0101, 1991).

U.S. Department of the Interior, *Report of the Secretary of the Interior to the Endangered Species Committee*, (Washington, DC: DOI, April 29, 1992).

U.S. Department of the Interior, *Recovery Plan for the Northern Spotted Owl (Draft)*, (Washington, DC: DOI, April 1992).

U.S. Department of the Interior, *Preservation Plan for the Northern Spotted Owl (Draft)*, (Washington, DC: DOI, May 1992).

U.S. Department of the Interior, Bureau of Land Management, *Pacific Yew Comprehensive Management Strategy (Draft)*, (Washington, DC: DOI/BLM, 1992).

U.S. Department of the Interior, Bureau of Land Management, *Public Land Statistics*, (Washington, DC: DOI, 1990).

U.S. Department of the Interior, Office of the Secretary, *Wetlands Stewardship*, (Washington, DC: DOI, 1992).

U.S. Department of the Interior, Bureau of Land Management, *Fish and Wildlife 2000—Watchable Wildlife*, (Washington, DC: DOI, 1992).

U.S. Department of the Interior, Bureau of Land Management, *Challenge Cost Share Projects*, (Washington, DC: DOI, 1992).

U.S. Department of the Interior, Bureau of Land Management, *State of the Public Rangelands*, (Washington, DC: DOI, 1990).

U.S. Department of the Interior, Bureau of Land Management, *Riparian-Wetland Initiative for the 1990's*, (Washington, DC: DOI, 1990).

U.S. Department of the Interior, Bureau of Land Management, *Waterfowl Habitat Management on Public Lands: A Strategy for the Future*, (Washington, DC: DOI, 1989).

U.S. Department of the Interior, Bureau of Land Management, *Special Status Fishes Habitat Management*, (Washington, DC: DOI, 1991).

U.S. Department of the Interior, Office of Program Analysis, *Adaptation and Climate Change*, Washington, DC: DOI, 1992).

U.S. Department of the Interior, Bureau of Reclamation, *Summary Statistics, Water, Land and Related Data*, (Denver, CO: DOI, 1988).

U.S. Department of the Interior, Minerals Management Service, *Mineral Revenues 1990*, (Washington, DC: DOI, 1990).

U.S. Environmental Protection Agency, Office of Air and Radiation, *Implementing the 1990 Clean Air Act: The First Two Years*, (Washington, DC: EPA, November 15, 1992).

ISBN 0-16-041612-4

FORESTRY

HAZARDOUS & SOLID WASTES

INTERNATIONAL ISSUES

NATIONAL ENVIRONMENTAL POLICY ACT

POLLUTION PREVENTION

PRIVATE SECTOR INITIATIVES

PUBLIC LANDS

TECHNOLOGY

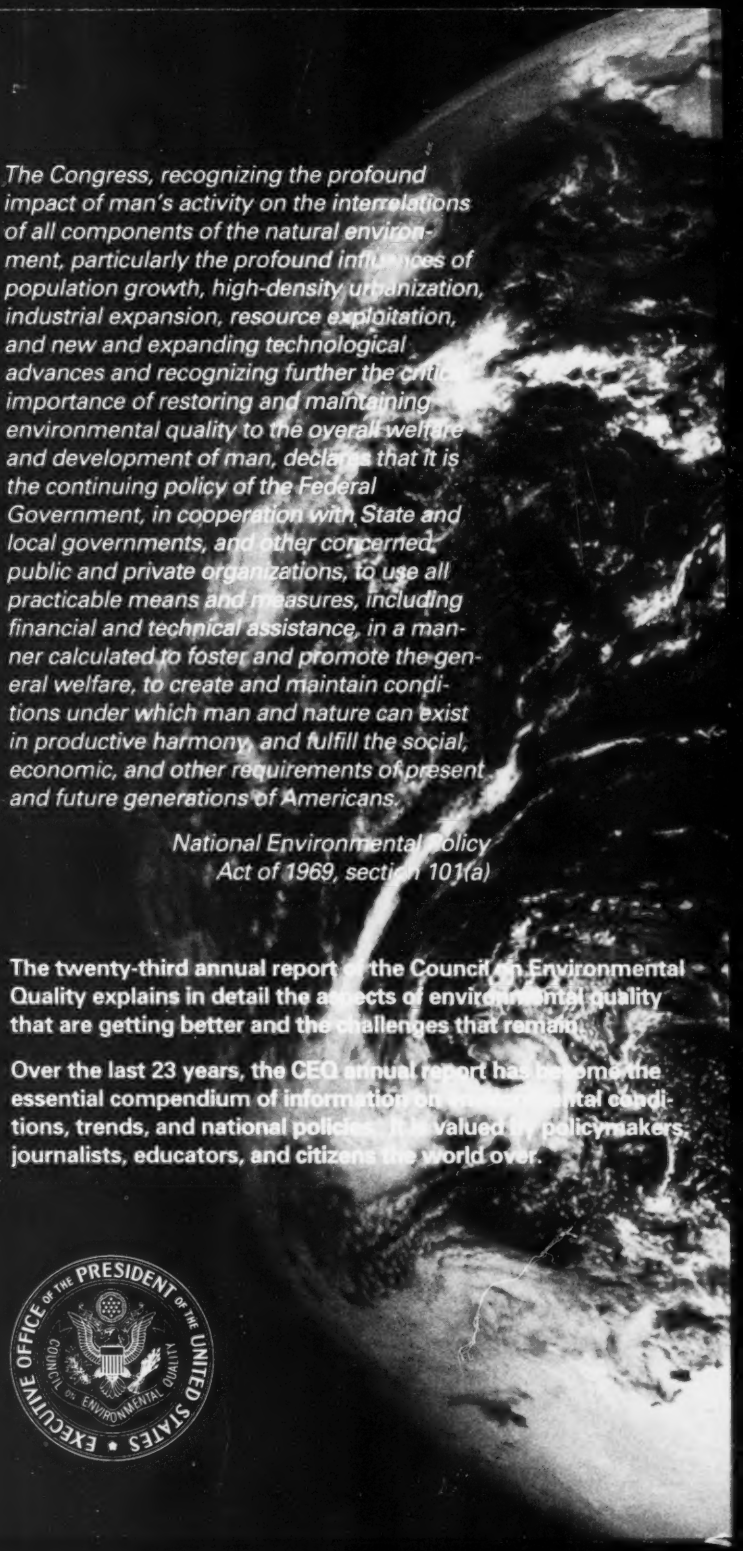
TRANSPORTATION

WATER

WETLANDS

DATA & TRENDS

THE STATES



The Congress, recognizing the profound impact of man's activity on the interrelations of all components of the natural environment, particularly the profound influences of population growth, high-density urbanization, industrial expansion, resource exploitation, and new and expanding technological advances and recognizing further the critical importance of restoring and maintaining environmental quality to the overall welfare and development of man, declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations, to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans.

National Environmental Policy Act of 1969, section 101(a)

The twenty-third annual report of the Council on Environmental Quality explains in detail the aspects of environmental quality that are getting better and the challenges that remain.

Over the last 23 years, the CEQ annual report has become the essential compendium of information on [illegible] environmental conditions, trends, and national policies. It is valued by policymakers, journalists, educators, and citizens the world over.

EXECUTIVE OFFICE OF THE PRESIDENT OF THE UNITED STATES
COUNCIL ON ENVIRONMENTAL QUALITY